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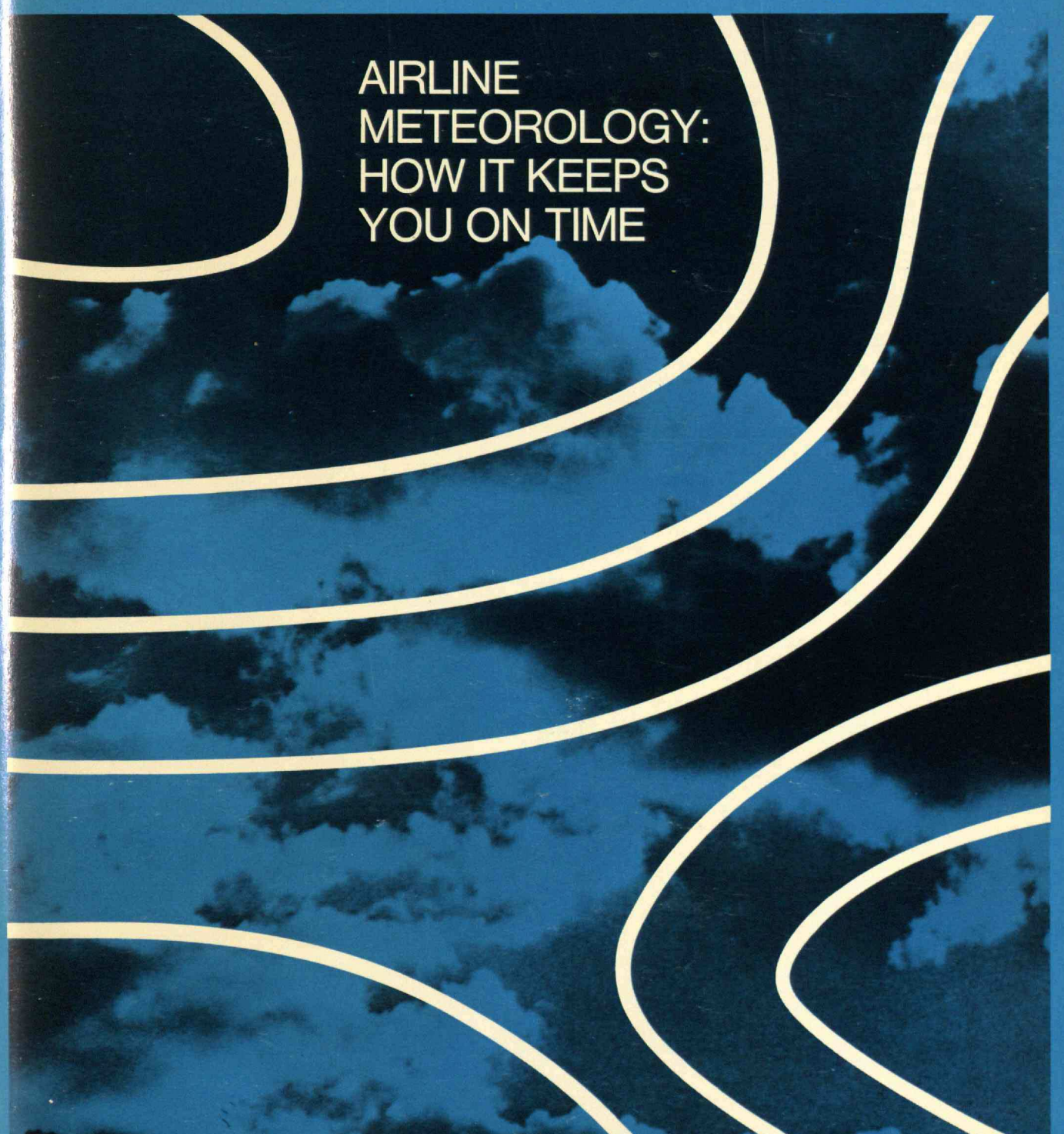
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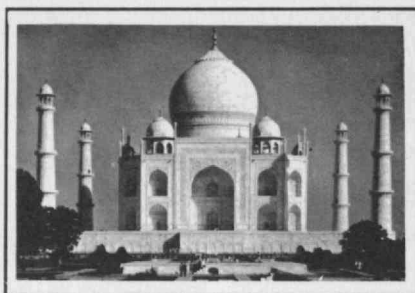
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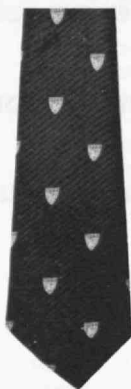


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First Line

- A Doubly Sharp Dilemma**
- Long-time readers of *Technology Review* can hardly fail to observe a modest decrease of advertising in our pages. This is neither a unique nor a disastrous development, but it represents an example of a quandary on which comment may be appropriate: At a time when the nation's future for innovative technology seems clouded by doubt, the real and potential fruits of science and engineering need to be better and better understood by Americans everywhere. But technology-based industry from which most innovation will come finds its financial future so obscure as to make uncertain those corporate programs which will contribute most to better public understanding.
- The Editors' dilemma is doubly sharp: the *Review's* circulation is now almost as large as ever in its history—though modest by most magazine standards—and our subscribers are renewing their *Reviews* at a rate higher than in several recent months. We share with colleagues throughout the magazine industry a malaise compounded of increasing costs and decreasing income, and we all seek ways to preserve what we believe are vital media of societal communication.
- One way, at *Technology Review*, has been to reduce the size of each issue—in physical dimensions though not, we think, in richness. Another has now been resolved: so that we can concentrate available resources into stronger and stronger issues, we shall omit what would normally be the fifth number of Volume 74. The next issue, designated March/April, will be published by about March 15; it will be worth waiting for:

Coming in March/April
A special issue on

Solid Waste

Bury it, burn it,
or recycle it?

Authors

W. Boynton Beckwith

"Airline Meteorology Today," pp. 11-19
joined United Air Lines upon graduation from M.I.T. in 1936; he served with the Boeing School of Aeronautics and the U.S. Weather Bureau during World War II, and he is a Fellow of the American Meteorological Society.

Gary A. Hack

"New Communities in a National Urban Growth Strategy," pp. 30-42
studied architecture and planning at the University of Illinois, has served as head of planning at Victor Gruen Associates, architects, of New York, and is now a Ph.D. candidate in the M.I.T. Department of Urban Studies and Planning.

Howard W. Johnson

"Special Report," pp. 8-9
is President Emeritus and Chairman of the Corporation of M.I.T.; his report is based on testimony before the Senate Committee on Public Works and Subcommittee on Air and Water Pollution.

Alvin Kaltman

"Computers in State Government," pp. 43-49
was Director of Systems Analysis, Data

Processing, and Telecommunications for the Commonwealth of Massachusetts before taking his present post, and he was a leader in founding the National Association of State Information Systems.

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Book review, pp. 70-71
is a visiting lecturer in the School of Management at Boston College.

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"New Communities in a National Urban Growth Strategy," pp. 30-42
studied at Harvard and M.I.T., where he is now assistant to the director of the undergraduate program in urban studies. He holds the Institute's 1971 Goodwin Medal for teaching.

Samuel J. Williamson

"Local Politics and Air Pollution," pp. 50-54
was a member of the technical staff of North American Rockwell's Science Center at the time of the events which he describes. His article was written while he was teaching at the University of California (Santa Barbara); he holds S.B. and Ph.D. degrees in physics from M.I.T.

Kenneth Zapp

"Industrialized Housing and Public Policy," pp. 20-29
is a doctoral student and Research Assistant in the Program in Science, Technology, and Public Policy at Case Western Reserve University. His earlier degrees are in psychology and economics, and he has taught finance and management.

bers to remove SO_2 . This does not include disposal of the CaSO_4 , but capital cost for this is very low.

□ He compares capital costs only, without even a passing reference to operating costs. Present regulatory plans call for fuel of less than 0.3 per cent sulfur, or the equivalent removal. Best published estimates for all-in costs of getting Venezuelan crude to this level (as contrasted with earlier limits of 1.0 per cent) are \$1.25/bbl. of oil. Such figures are twice the best estimates of \$0.60 for sulfur removal by limestone.

□ He neglects to consider the time scale in comparing approaches. Wet scrubbing has had its problems, as all new processes do, but commercial installations are being made now with increasing frequency.

His alternate approaches are at least 15 to 20 years away after they, too, have gone through development and full-scale testing under commercial conditions.

The Clean Air Act of 1970 calls for widespread commercial results by 1975. The stack gas removal processes Professor Squires derides must be used in some form to achieve this legislative mandate. They are the first generation. His desulfurizing approaches are probably a third generation for the 1990's or beyond. In between there probably will be a second generation for the 1980's.

It is important for us all to keep perspective and to help the first generation achieve commercial results in order to advance the overall cause of improving the quality of our environment.

Russell L. Haden
Harbridge House
Boston, Mass.

Letters

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Perspective on Desulfurization

I am dismayed by some of the statements of Arthur M. Squires in *Technology Review* for December ("Capturing Sulfur During Combustion," pp. 52-59).

The whole thrust of Mr. Squires' article is in his choice of words, such as "nothing could be further from the truth" than "that one of our most stubborn combustion problems has been solved" (removal of SO_2 from stack gas). He then cites "costs [which] will apparently range as high as \$70 per kw." and compares this maximum figure unfavorably with \$13 per kw. capital cost for desulfurizing Venezuelan crude. With this capital comparison as a springboard, he goes on in his article to explore other approaches to treating fuel before combustion.

He neglects several vital points:

□ As noted above, he compares a maximum of a range with a single figure. Engineering companies active commercially in the business are willing to quote for installation now \$15/kw. for wet scrub-

More Than an Agent

Certainly no one is better qualified than Jacob Rabinow to review a book on inventors ("Inventions-People and People-Inventions," *Technology Review* for July/August, 1971, pp. 14-15), but it is not clear to me whether he implies that Research Corp. acts as an "agent" in handling the patenting and licensing of inventions. Just in case other readers may also be unclear on this point, I think it may be worthwhile to explain the actual role played by the foundation.

Research Corp. is a nonprofit organization established in 1912 by Frederick Gardner Cottrell to render inventions, patent rights, and letters patent "more available and effective in the useful arts and manufacturers and for scientific purposes." To this end, the foundation helps evaluate, patent, and license inventions arising from research at well over 200 nonprofit institutions in the U.S. and abroad.

Most of these inventions are embryonic and frequently so far in advance of current technology as to require massive research and development. The foundation helps bridge the chasm between the academic inventor, who has usually not been able to reduce his inventive concept to practice in more than a minimal way, and the industrial concern, which must provide the necessary technical and commercial facilities to bring the embryonic invention to the marketplace.

Research Corp. fills much more than an agent's role. The foundation's technical staff evaluates the invention's patentability and commercial potential, obtains both domestic and foreign patent coverage, seeks out potential licensees, negotiates and administers licenses and protects the patents against infringers—at no expense to the inventor or his institution. This is true even if, in spite of the extended and sometimes costly effort, an academic invention produces no royalties whatsoever.

Royalties to faculty inventors from successful inventions are generally determined by the inventor's institution. While many institutions favor 15 per cent of gross royalties received, higher percentages are common.

It is important to note that, after the inventor is compensated, royalties from inventions handled by Research Corp. are divided equally between the inventor's institution and the foundation. In keeping with its chartered objectives, Research Corp., after paying all expenses in patenting and licensing, devotes remaining royalties to paying the costs of patent assistance and supporting fundamental research in the natural sciences and applied nutrition.

Willard Marcey

Vice President—Patents
Research Corporation

Science Review

Robert C. Cowen

Betting on Solar Power

Solar energy has been promoted as the poor man's heat and the rich man's convenience. It's great for desalting water in the Greek Islands or running a satellite in space. But you've been told you can forget about it on the big power scene—or can you?

The notion of "poor man's heat" may well be a concept whose time has gone. Technological progress now points to ways to overcome solar energy's twin limitations—dilution and intermittent availability. President Nixon had this in mind when he delivered his energy message last spring. "The sun," he observed, "offers an unlimited supply of energy if we can learn to use it economically. The National Aeronautics and Space Administration (N.A.S.A.) and the National Science Foundation (N.S.F.) are currently reexamining their efforts in this area and we expect to give greater attention to solar energy in the future."

N.A.S.A., it turns out, is merely looking at solar cells to see if they can have wider usefulness. N.S.F., however, is backing basic research on a technology that could turn sunshine into the kind of high-grade heat a modern steam generator needs. This includes energy-trapping films which absorb solar energy

efficiently but re-emit it only poorly. It includes, also, advanced phase-change materials that could store vast amounts of energy for use when the sun doesn't shine.

All of this research is small-scale. Its main implication is that you should begin to think about the possibility of using sophisticated technology to make the most of what the sun gives us. The rather far-out scheme for an orbiting power plant proposed by Peter Glaser of Arthur D. Little, Inc., has been valuable largely as a stimulus to such thinking.

For some years now, Dr. Glaser has been talking, for example, about a system to deliver 10,000 Mw. of electric power to earth. He would use a 25-square-mile array of solar cells in synchronous orbit. Converting its energy to radio waves, he would beam them to a 36-square-mile receiving antenna on earth. This would consist of an array of units scattered over fields in which cows might graze or crops grow uninjured by the incoming beam.

Admittedly the solar cells would be inefficient. They convert sunshine to electricity at about 8 per cent efficiency now. With development, this might be doubled. Given that, Dr. Glaser thinks the microwave transmission could be made to work at 70 per cent efficiency. He thinks the whole scheme could gather and deliver enough power to realize his 10,000 Mw.

Only a long development effort could bring this plan into being and prove out its economics. As Ernst Stuhlinger, Associate Director of N.A.S.A.'s George C. Marshall Space Flight Center, says, the important point about the concept today is that, "from a technical standpoint, the scheme is definitely feasible." And that is enough to puncture the myth that solar energy is inherently unsuitable for central-station power.

A Solar-Industrial Complex

Aden Meinel, Head of the University of Arizona's Optical Science Center, says, "Peter Glaser's proposal broke the spell that was suppressing the field. He stimulated us to think in these terms and did a very great service." And Dr. Meinel thinks in very big terms indeed. Together with his wife Marjorie, he is studying selective absorber coatings. With these, he envisions eventually designing 1,000-Mw. generating plants whose waste heat could also be used to desalt water. He sees no obvious limitation that would prevent linking such plants in a Southwestern United States energy complex that would provide power for that whole region plus all the water it needs.

These selective coatings absorb like black bodies in the visible part of the spectrum where solar energy peaks. They re-emit energy in the infrared rather poorly, so they can efficiently trap what the sun is sending in. Dr. Meinel points out that conventional ways of trying to concentrate solar energy, using mirrors or lenses, have been very discouraging. Typically they show efficiencies of under two per cent, which he attributes to trying to work at too low a temperature. He expects to find coatings that could be used to produce steam at

about 540°C. and 84 kg./cm.², right in the range where utilities want it.

He would soak up heat from the coatings by a flow of coolant, probably liquid sodium. He notes he should have less trouble with this cantankerous metal than do breeder reactor engineers because he would have no radioactivity problems. The sodium, in turn, would carry the heat to a storage reservoir charged with a eutectic salt mixture. Storing energy as latent heat of fusion, such a mixture could accept and release vast amounts of energy at constant temperature. A secondary coolant loop would extract heat for raising steam. In this way, Dr. Meinel estimates he could store enough energy to keep a plant operating smoothly even if the sun didn't shine for two days. He would, of course, set up shop in the desert to ensure as clear a sky as possible.

Such a system, he thinks, could operate with an overall efficiency of perhaps 30 per cent. That's not a bad share of the "free" energy coming from the sun. Clearly, he admits, only long development will produce such a system. Its economics are impossible to foresee with precision, although he believes they would be favorable. The key factor is the coatings—especially their durability.

An Energy-Trapping Sandwich

These elements come in two basically different types. Bernard Seraphin at the University of Arizona has done much work with a semiconductor which soaks up sunshine while transmitting infrared rays easily. Underlining such a material with something that emits poorly in the infrared—for example, gold—gives an energy-trapping sandwich. Dr. Seraphin points out that this application depends on the thermal and radiational properties of the semiconductor, not its electrical properties. This, he says, means it should be orders of magnitude cheaper to make than the material used for solar cells.

Another type of heat trap uses an interference effect. In this, materials such as molybdenum, aluminum oxide, and quartz, which are reflective or transparent over the visible and infrared regions, form an interleaved stack. Adjusting the thicknesses of the layers precisely gives an energy-trapping interference system.

The figure of merit for all of these coatings is the product of the optical concentration of incoming sunshine multiplied by the ratio of the absorbance in the visible to the emission in the infrared. Ideally, it should be about 40. If the absorbance-emission ratio of the coatings were already 40, you could get away with no concentration at all. Dr. Meinel says that coatings he now works with have ratios in the 10 to 20 range. He thinks one could use these with a simple, inexpensive lens to give a workable energy-gathering system. But he also thinks that further development could well produce coatings that could work on their own.

Right now, Dr. Meinel has a small N.S.F. grant to look into the merits of various coatings, to try to define better their problems and potential. Dr. Jesse C.



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Denton, whose N.S.F. office reviews such solar energy research proposals as those of Dr. Meinel, warns you to take the vision of 1,000-Mw. power plants with reservation at this point. But that reservation shouldn't be so strong as to put the possibility of such plants completely out of your consideration. He says, "Solar energy, in my opinion, is one of the real possibilities for the long-term future." He calls the selective coating concept "in principle, a very sound system."

Solar Energy in Perspective

Dr. Meinel respects such statements of reservation. He knows he has a lot to prove. His aim now, beyond his research on the coatings, is to change our perspective in thinking about solar power. If it is ever to come at all, he says, it must come on a very large scale. And unless energy planners get used to thinking in such scale, they will continue to regard solar power more as a joke than as a serious possibility.

Certainly the land areas involved seem staggering. At 30 per cent efficiency, a 1,000-megawatt plant would need a collector area equivalent to a square 3.8 kilometers on a side. Since collectors can't be crowded, lest they shadow each other, Dr. Meinel estimates two to three times this much land area would be needed. Adding up all the figures, he thinks a one-million-Mw. complex of solar power stations would use an area equal to a square 118 kilometers (74 miles) on a side.

That sounds impossibly wild at first. Yet he insists such a project to be a practical goal. Furthermore, he says, one could happily distribute the collecting areas for several million megawatts of solar power plants over the six or seven sunny western states. It would involve only about one per cent of the land the United States now reserves for farming, less land than strip mining now despoils. If we start thinking in terms of "energy farming," Dr. Meinel says, the collector-area land requirements of solar power won't seem so awesome.

Still trying to put the subject in "correct" perspective, Dr. Meinel points out that solar power won't be pollution-free. While the fuel will indeed be "clean," 30 per cent efficiency of energy conversion means a lot of waste heat. This could best be used, he thinks, as part of a desalting project. Again, this would work best in enormous sizes. Dr. Meinel envisions a cooperative enterprise with Mexico, since the handiest water source for a Southwestern American project would be the Gulf of California. He estimates his system could produce all the water that region would need. Waste brine could be sent back to the Gulf. If properly diluted upon discharge, this should not effect the Gulf's salinity. Dr. Meinel estimates it would amount to a yearly salt concentration equivalent to that of evaporating a millimeter or so a year of water from the surface of a water body whose annual evaporation runs to a couple of meters.

This glorious dream would take decades to realize. Dr. Meinel is thinking beyond the year 2000. But then so are the energy planners who hope to phase

the economy out of fossil fuels and into atomic energy over the next 30 to 50 years. If you look at it against this time scale, the message that Dr. Glaser, the Meinel, and a few other solar-energy prophets are trying to put across deserves serious consideration today.

The only long-term energy hopes we have without solar power are the breeder reactors and hydrogen fusion. As articles in *Technology Review's* energy series point out, either or both of these theoretically could meet our needs. But to rely on breeders alone would mean a terrifying accumulation of radioactive wastes plus herculean efforts to mine enough fuel. Fusion could be a neat solution. Yet we do not now have any more real hope that fusion will become economically possible than Dr. Meinel has for his desert power farm.

Indeed, the solar energy prophets legitimately point out that, in terms of what we really know today, we have as sound a scientific basis for betting on solar power as we do for betting on fusion. Under the circumstances, their plea for at least as much serious research support as we give to fusion deserves a careful hearing.

National Report

Victor McElheny

Exploration as Man's Destiny

The historian who chronicles the space age may well arrive at a determinist outlook: he may conclude that the shower of rockets, satellites, space probes, and journeys by astronauts burst upon mankind just about as soon as it possibly could have.

The historian may also find that the politicians' real latitude of choice about such things as the pace and direction of the space effort was quite narrow. Indeed, we already, during the first 14 years of the space age, have seen the upper and lower limits of spending on extra-terrestrial activity in a pluralistic society like the U.S.—a maximum of about \$8 billion a year (including military work) and a minimum of \$4 billion.

The arguments for such a determinist view of the era of space exploration go beyond the kinds of narrow constituency pressures which operated on the awards of major contracts or the placement of new space centers. More subtle cultural and psychological pressures still operate.

Perhaps the most important of these is the enormous impact of exploration of the earth as an accompaniment to post-Renaissance civilization. The ever-widening view of the earth brought back as the cargo of explorers' ships over several centuries did more to accustom the mass of men to continuous intellectual change than did the analogous explora-

tions taking place in observatories and laboratories in the past 300 years. The meaning of an age of science is that there are no absolute truths fixed forever. The voyages of explorers to new lands embody this for most of mankind.

Opening the Age of Exploration

The exploration first carried on by the Catholic powers Spain and Portugal, and later taken up by the Protestant powers England and Holland, had strong religious and commercial motives. But activities that were basically scientific played an astonishingly large part.

The chief direct accomplishments of Columbus' voyages were the opening of navigation across the Atlantic and the exploration of the Caribbean Sea. Although one ship did return to Spain from Magellan's voyage loaded with spices, the chief direct result was the measurement of the true width of the Pacific Ocean. Cook's voyages began with an excursion to Tahiti to observe a transit of Venus, which provided in those days crude material for calculating the distance between the Earth and the sun, the astronomical unit. The discovery of the continent of Antarctica around 1840 (some 70 years after Cook sailed completely around it) was the result of voyages by British, American, and French expeditions to gather data about terrestrial magnetism for Gauss' Göttingen observatory in Germany.

The necessities of navigation over a planet three-quarters covered by water were close to the philosophically central discoveries in the fields of astronomy, physics, and optics. The same moons of Jupiter which provided Galileo with an analogy to a system of planets revolving about the sun, and whose motions yielded the first calculations of the absolute speed of light, were also a crude device for measuring longitude on the earth.

It was no accident that in an age of exploration the pupils of the Swedish taxonomist Linné undertook voyages to remote places to study the varieties of the living world; or that Darwin's studies of the relations between living species and their geologic environments occurred during a five-year, round-the-world voyage financed by the same Royal Navy that had sent Cook and would later send Scott to Antarctica.

The links between exploration and literature are so numerous they are sometimes overlooked. A fascinating example of the powerful hold of exploration over a literary imagination is Joseph Conrad's evocation of the spirit of the Thames River at the opening of his story, "Heart of Darkness." The *Erebus* and *Terror* (two ships lost in the search for a Northwest Passage in the 1840's), Conrad indicates, were bound on conquests of knowledge. "What greatness had not floated on the ebb of that river into the mystery of an unknown Earth!"

Literary Grappling with Future Shock

Almost since then, science fiction—dominated by the idea of voyages to the moon and planets and stars—has been an important theme in literature, a natural literary accompaniment to a world in

which exploration over the seas and in the laboratory spurred the mechanical revolution.

The science fiction of Jules Verne comes to full flower in a time when rail-roads, telegraphs, iron steamships, and the transatlantic cable all were new. These technologies were so brilliantly celebrated at the Crystal Palace Exposition in 1851 that their cumulative impact could hardly have been ignored.

In the same period, photography was first applied to astronomy and spectrograms of the sun during an eclipse visible in India led to the discovery of helium, not then known on Earth. Systematic observation of Mars began only in 1877, when that planet's two tiny moons were discovered and the first dust storm observed—along with channels that soon became the "canals" of a mythic Martian civilization. So Jules Verne wrote quite a realistic tale about a voyage to the moon which began with the firing of an immense cannon near Tampa, Florida. It seems fitting that the same literary imagination devoted itself to *20,000 Leagues Under the Sea*, a book dominated by the problem of how man can live in greater harmony with the rest of the living world.

Technology Accelerating

Since then, a steady stream of new astronomical knowledge about the planets and indeed the universe, revealing its immense scale of distances, has fed a stream of books about life on other planets and invasions of Earth—all of which can be regarded as literary grappling with a chronic case of future-shock. Indeed, one of the leading science fiction writers today, Arthur C. Clarke, gets much of the credit for the idea of a communications satellite.

This idea came forward just as the real development of rockets in Germany before and during World War II—spurred at the beginning by Fritz Lang's science fiction movie, "Girl in the Moon"—was making space travel feasible. Then came an ever-accelerating development of technology—rockets, nuclear and thermonuclear explosives, fast, large, and dependable aircraft and the rapid evolution of aerodynamic science, microwave communications and electronic computers.

It was only 13 years from the German campaign of bombing England with V-2 ballistic missiles to the launching of Sputnik I. The U.S. launched its first scientific satellite in January 1958, less than three years after the U.S. determined on an all-out development of intercontinental ballistic missiles. The first weather satellites went into orbit in 1960 and so did an aluminized mylar balloon for bouncing radio signals from one station on Earth to another.

The first man went into space in April, 1961, and man's landing on the moon occurred only 23 years after U.S. technicians bounced a radar signal off its surface.

It is hard to see how the pace could have gone much faster—and equally difficult to attribute this pace solely to the rivalry of two great powers or to the requirements of constituencies. The

power of imagination, shaped by three centuries of exploration, must have been more than a minor factor.

There were, of course, other influences. Fear of other nations gave rise to great arsenals. Then there was fear of the weapons which had been created; defenses in space were an obvious response.

Many people on both sides of the iron curtain asked how they could help achieve collaboration between the great powers and divert talent, time, money, and devices to peaceful uses. The International Geophysical Year was one answer. The I.G.Y. showed how space exploration could contribute to international understanding: the launching of Russian and American satellites was one of its crowning events, and one of the latter discovered the Van Allen belts of charged particles trapped in the Earth's magnetic field.

The diversion of resources from military weaponry to a peaceful space program was significant, amounting to billions of dollars a year for a decade, and can be counted as the most significant disarmament step taken during the 1960's.

The universal public fear of the consequences of an all-out nuclear war was another pressure. It helps explain why N.A.S.A. currently focusses extraordinary attention on the possibility of joint flights by American and Russian astronauts in 1974 or later.

But the most significant non-political and non-economic pressure for continued space exploration comes from the imaginative impact of what has happened already in space. There has been an enormous change in man's view of his environment, amounting almost to a cultural revolution. Manned and unmanned space expeditions have produced a flood of new views of the earth, the moon, Mars, Venus, and the universe beyond our solar system. A Tiros weather satellite showed views in 1960 of a cloudless Sinai. There were enough photographs of Earth by Mercury, Gemini, and Apollo astronauts to make an atlas. There were two black-and-white television tours of the moon from orbit on Apollo 8 and similar tours in color on later Apollo missions.

For an hour during Apollo 10, its color camera focused on a faintly brown moon, receding as the ship burst away toward Earth. The same flight had shown color views of the earth receding, matching the still photographs of the same sight from Apollo 8. Soon thereafter came the brilliant color transmissions from Apollo 14 and the almost unimaginable intimacy of eight hours of television from a jeep-borne camera that went with the Apollo 15 astronauts on their journeys through the strangely softened terrain near Hadley rille.

Such scenes, only the latest and most compelling in five centuries of exploration, are not alien to the culture we live in. They are central to it. The prospect of such adventures was certainly a factor in starting the space age at virtually the earliest possible moment. The realization of hopes that had been raised in fiction does not close a door on space exploration. It opens it, forever.

Special Report

Howard W. Johnson

Toward a National Policy for Environmental Research

Perhaps the outstanding characteristic of environmental problems is their pervasiveness in both space and time. Environmental quality is affected by factors which interact among themselves. Environmental deterioration, in turn—especially if it occurs in a fairly short period of time when compared to the time scale of biological evolution—is liable to profoundly alter mankind's age-old aspirations towards progress. These facts, which have been documented over and over again, underline the difficulties that we experience when we attempt to define and categorize environmental problems in order to deal with them one aspect at a time. Our standard analytical methods, our classic research and development approach which has served us so effectively when dealing with such problems as a complex weapons system or even a limited environmental problem as in the Apollo capsule, seem scarcely adequate in relation to problems that differ so profoundly in both scale and complexity.

These intellectual obstacles call for institutional innovation. Whatever structure or, more likely, system of institutional structures emerges will have to satisfy many purposes: both basic and applied research, development, demonstration, early warning, post-hoc evaluation, and feedback. This system will have to serve and educate the policy-makers, the operators of regulatory agencies, and the industries and professions involved, as well as our citizenry at large.

Our great national laboratories—Los Alamos, Livermore, the Jet Propulsion Laboratory, and M.I.T.'s Lincoln and Draper Laboratories, to mention just a few—have been enormously successful, and it is tempting to proceed on the assumption that a similar approach will be similarly successful in providing the understanding we need to manage the interface between our modern technology-based culture and its natural environment.

In addition to the superb technical leadership which these great national laboratories have enjoyed, most of them have been characterized by having well-defined problems, ample funding, and tight coupling to their government sponsor. But there are exceptions: Some national laboratories, such as Brookhaven, operate in a different manner. Here, for example, the scientific peer group in high-energy physics represents the body to whom the laboratory is in some sense coupled or accountable.

Because of these variations of form and

purpose, and because of the special nature of our environmental problems, I am inclined to think that the success of the national laboratory approach deserves to be studied in much more detail than has been done up to this point before we draw general conclusions about the institutional instruments that will enhance in a truly massive manner our understanding of the ecosystem, so that we may effectively prevent and abate the many detrimental effects.

Five Elements of a National Effort

If we take as given the scope and variety of our environmental problems, our need to associate this effort with different institutions in our country and with different regions, different industries, and different types of environmental degradation, we may fairly conclude that we need a pluralistic undertaking and not any single laboratory instrument. Since environmental quality is now clearly everyone's concern, we need to develop a conceptual framework within which human values and social and economic considerations will aid and shape the formulation of scientific, technical, and societal tasks.

Whatever studies there are on productive research settings—especially those in which problem identification is a major task—support the view that scientific progress is encouraged by structural diversity. Participation in problem-definition and problem-solving activities by groups and institutions composed of diverse elements seems to facilitate scientific advance. The problem is to bring this diversity together and to choose the most productive and effective matters to follow.

The above premises would lead me to encourage a variety of substantially expanded environmental activities, among which I shall single out for discussion just the following:

□ Research and educational activities in institutions of higher education (see further below).

□ Research and development laboratories coupled either to institutions devoted to the generation of knowledge or to industrial or regional groupings or to governmental (operating, regulatory, etc.) agencies that are interested in and capable of using the laboratory output effectively. The notion of "coupling" points to a dilemma: in many instances the feedback will be beneficial in leading to a quicker shaping up of a program. But there is also a problem regarding the extent to which, for instance, a mission-oriented agency should be tied to either analytical or monitoring activities of a laboratory. Institutional inventions are needed to guarantee the objectivity and veracity of laboratory findings that have been sponsored by a special-interest client. It may well be that eventually one or two institutions that assess technology on behalf of a multiplicity of environmental consumers will become necessary if for no other than psychological reasons.

□ One or several laboratories whose concern is primarily with long-range research. Their interaction with the more tightly coupled laboratories will be in

the nature of keeping each other focussed on the task of anchoring and calibrating each other.

□ Groups specializing in the presentation of policy alternatives and capable of developing comprehensive cost-benefit analyses for each alternative. Here we have to find out whether and how we can meaningfully aggregate and compare economic costs and benefits with social and aesthetic factors. Here we shall have to work on ways of reconciling today's costs and benefits with our responsibilities for the welfare of future generations in this and other lands. These policy-oriented groups will have ready-made customers in the Executive Office of the President, the Congress, and the Council on Environmental Quality, as well as in comparable bodies at state and regional levels.

□ A scholarly institution that will contribute to public policy-making and public education in the environmental area. The analog that comes to mind is that of the Brookings Institution, which defines its role as that of "independent analyst and critic committed to publishing its findings for the information of the public."

These seem to me the major components of a national research and development effort in the area of the environment. It is difficult for me to see how all these functions can be included under one roof.

The Role of Universities

Institutions of higher education bring with them a special subset of assets and liabilities as they try to respond to the environmental imperative. There is a very obvious and growing concern on the nation's campuses with problems of environmental quality. All segments of the academic community are eager to see new programs in environmental education and research. In addition to the students, the enthusiastic organizers of so many "earth days" and other symbolic events who were truly in the vanguard of a national trend, a large and serious breed of environmentalists is emerging whose vision of the future is very much in tune with needs. Scientists and engineers are eager to become involved in projects through which their talents will contribute to the common good—and this is not at all simply because so many of their fellow citizens seem to indict technology as the main contributor to environmental degradation. It is an unfortunate misconception that technical people are inherently narrow in their approach to problems or unwilling to change the direction of their technical efforts. In my judgement this is not the case today and has historically not been the case.

What contributions can these people make? Important aspects of environmental problems involve many academic disciplines. The engineer sees an opportunity to develop new processes and plant design to reduce the costs of environmental pollution and its control, and a need to develop new techniques for technological assessment. The physicist and chemist see a need for improving our understanding of the behavior

of pollutants in air and water. The biological and medical scientist sees many opportunities to test his knowledge of physiological and psychological responses to environmental factors and especially of the effects of mutagenic agents. The political scientist and economist are particularly concerned with assessing alternative ways of improving environmental quality and with developing mechanisms for the orderly realization of technological change. Indeed, many professional disciplines view environmental programs as exciting new opportunities.

New university education and research programs which are to respond to these new opportunities will require some modifications of existing academic practices. Environmental problems are so complex that effective research or educational programs will usually involve a number of disciplines. New mechanisms will be required to facilitate the cooperation of a number of different departments.

The university's contribution will be of two kinds. Our programs will educate a new generation of students to deal with environmental problems in industry or government; they will differ from their predecessor graduates by having emphasized the interdisciplinary character of problems, and—in many cases—by their exposure to "real world" situations. And university research programs will undoubtedly yield important advances in methodology, in basic understanding of natural phenomena in the environment, and in the development of new systems.

Of course there are important research and development activities that are not best carried out at institutions of higher learning. For example, the development and production of major hardware systems or the testing and evaluation of large-scale demonstration programs may not be best carried out by universities, though some may want to be associated with at least the initial stages of such undertakings. The federal government and industry will have to look chiefly to their own laboratories and to non-profit research organizations for hardware development and demonstration work.

Indeed, it should be policy to support high quality research and development on environmental problems wherever it is proposed, regardless of any agency's traditional role and mission. The surest way of realizing rapid and desirable technical innovation is to permit an unfettered competition of ideas. No single institutional model should be established for federal support for research and development in the environmental area.

Toward a National Strategy

In my judgment the primary concern of the federal government today should be the formulation and enunciation of a coherent national strategy for research and development on environmental problems. This strategy should provide a clear indication of the kinds of questions that need to be answered and the kinds of capabilities that the nation must acquire.

Though I do not propose to dictate what such an environmental research and development strategy would be, I

am willing to speculate that such a strategy would have educational programs as a major element. The recent decline in federal fellowship programs, institutional grant programs, and research and development expenditures at colleges and universities, when coupled to rapidly increasing educational costs, make exciting new teaching and research activities in the environmental area very difficult for academic institutions. A balanced program in the environmental area would certainly include major support for educational innovation. The shortage of trained manpower with specialized knowledge about how to deal with environmental problems will not end until resources are made available for new educational ventures. One among these that might deserve special support is a program of continuing retraining of scientists, engineers, government officials, managers, etc., in the new knowledge about the environment that we already have—and which will be augmented in the years and decades ahead.

The involvement of institutions of higher learning in the nation's environmental program offers an additional incentive to both the nation and the universities. Isolation of these problems in government or private laboratories might shield certain disciplines—and certain talents—from contact with problems towards the solution of which they might contribute. If the universities are to move towards research that is related to a broader spectrum of true national needs, they need the opportunity to become an important part of this program.

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Airline operations have always been subject to interruptions and delays because of weather. But as airways and airports are taxed by ever-heavier traffic, weather becomes an enormously important factor to operators as well as passengers

Today's air traveller may find himself in a holding pattern over his destination as a result of bad weather at another airport, many hundreds of miles away. Because traffic has grown faster than the capacity of the airports and routes, we now have a system with very little play in it, and one delay leads to another. It is the business of the airline meteorologist to provide the flight-dispatcher, traffic controller and pilot with the information they need in order to plan ahead as realistically as possible.

Although there are still delays, there is not the danger that there once was. The year 1970 ended with no fatal accidents to passengers or crews in scheduled air carrier operations within the United States. This remarkable achievement, attained while racking up a total of nearly 2 billion revenue airplane miles, is testimony to the efforts of many people in aviation and aviation-related industries where safety is, and always has been, the foremost guiding philosophy.

A broader statistic (based on a preliminary 1970 analysis of aircraft accident data compiled by the National Transportation Safety Board) is that in the same 12-month period, 41 accidents occurred to U.S. scheduled air carriers in domestic and international passenger service, of which 19 involved weather as the major or a contributing causative factor. This emphasizes a fact known since the Kitty Hawk flight of 1903; that, like the sea, the air around us is unforgiving to those who let down their guard.

The airlines of the United States in their early struggling years recognized the need for their own weather departments to supplement the aviation services provided by

the U.S. Weather Bureau. Today meteorology departments are provided by eight domestic airlines, about the same number as existed 35 years ago when they were first being established. The number of weather offices maintained by the airlines is less today than in the 1930's, and the total forecaster complement on airline payrolls is also smaller. Why this reverse trend? The answer lies not only in a lesser impact of weather on today's airline operations, but also in improvement of weather communications and computerization of many aspects of the forecasting task. This applies equally to the airline weather services and to the government facilities and services upon which airlines depend heavily (some airlines completely).

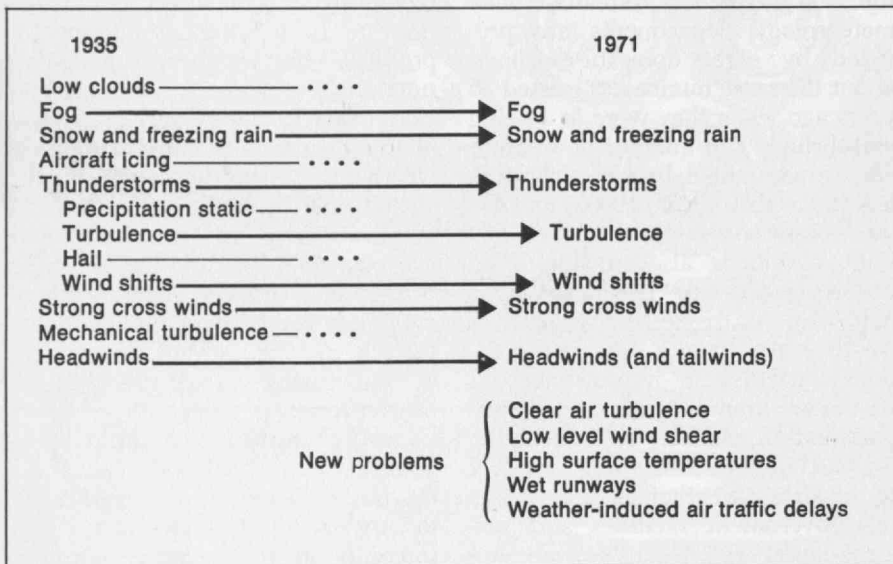
As the table on the next page shows, five types of weather problems which were once responsible for serious delays and interruptions, and a threat to safety, no longer exist today. And the effects of the six meteorological factors that are still with us from the 1935 list have been lessened by the great strides made in aircraft development and maintenance, in ground and airborne navigational systems, in weather communications, in airport field facilities and in more exacting pilot training. At the same time, it is well recognized that the introduction of each new generation of aircraft has been accompanied not only by a de-emphasizing of some weather problems but by the unfolding of a new set. Although the range and altitude capability of the subsonic jet transport permits it to fly around or over much of the "bad weather" enroute, there are today five weather-generated obstacles that airlines did not face in 1935.

There are also two atmospheric

factors in aviation operations which have not been listed here as weather problems, but which are interesting nevertheless: wake turbulence, and static electricity discharges. The first of these—a kind of aircraft-induced weather, outside the realm of the airline meteorologist—has received much attention since the jumbo jets started flying. Research by N.A.S.A., F.A.A. and Boeing Aircraft Company has pretty well pinned down the characteristics and movements of the vortices generated by the larger aircraft, which have been known to overturn small craft flying behind them at airports. Avoiding the hazard is now a matter of maintaining adequate separation (enforced by air-route traffic controllers or local tower control) and piloting know-how.

Static discharges are not precisely predictable. They can startle passengers and crew, but are not really a hazard or an economic loss-maker. The atmospheric conditions under which the static discharge occurs have been well recognized by the airlines since the days of the first DC-3 and, surprisingly to some researchers, are *not* necessarily pre-conditional upon thunderstorms. Minor damage to aircraft occurs in about a third of the reported cases—mostly burn marks on the outside skin.

To return to airline meteorology proper—and the airline meteorologist: An airline employs anywhere from a few forecasters to 25 or 30, plus in some cases a small clerical group to assist the professionals in chart plotting and organizing the flow of weather data. Staff size depends upon the magnitude of the operations to be supported, the route structure, the type and frequency of weather problems faced, and the



Five types of weather problems which were once responsible for airline operating delays have ceased to exist as causes of interruptions, and six others have been reduced in effect by techno-

logical developments of the last 35 years. But new technology has also resulted in a new set of five problems to which earlier aircraft and airline operations were not susceptible.

corporate philosophy of the airline. The objective is to maintain safety, minimize disservice to customers and keep operating costs down. In effect, the flight crew, the flight dispatcher, and the meteorologist work together in planning each flight (although not with the personal contact of former times). The largest carriers also have an operations planning center which must be kept updated on weather expectancies across the whole system.

Weather briefing of the pilot by the meteorologist, which in the early days of airlines was as important to the pilot as the production of the weather forecast, has gradually been disappearing. It is no longer eco-

nomically feasible to provide a briefing meteorologist at every flight planning point. In United Air Lines, for example, some 1400 originating flights require individual planning every day at 80 stations. It is also a fact that because weather problems affect safety to a much lesser degree than 20 or 30 years ago, the pilot and dispatcher can be effectively briefed via direct phone lines to the forecast office, or by "self-briefing" on the part of the flight crew.

For flight personnel to be able to brief themselves on weather conditions requires some intensive training, not only in the basic physical principles of synoptic meteorology (which they must have anyway),

but also in the interpretation of the several facsimile weather charts which are posted in the flight planning area at selected stations. A typical trunk air carrier may provide 15 to 20 of its stations with facsimile map service, their selection being based on the numbers of flights they originate—more particularly, long-haul flights. The weather display presented to the self-briefing crewman also includes government and company weather forecasts and reports.

The logistics of receiving, processing, and transmitting weather intelligence in an airline are complex, involving government and company land lines, facsimile circuits, computers, radars, the aircraft themselves, and air-to-ground radio.

New Weather Sensors

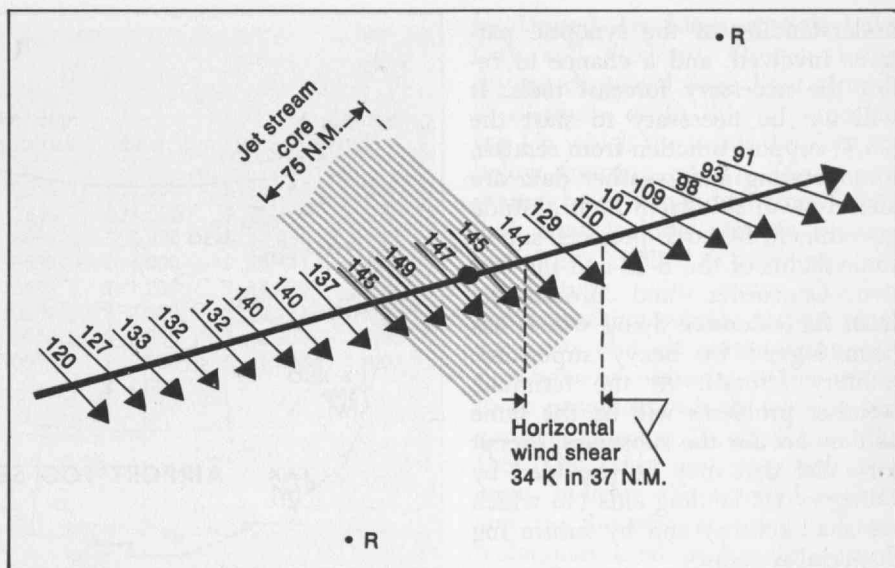
Much has been said about satellite meteorology and what it has done to further knowledge of the atmospheric "engine." For aviation, this new tool has so far not provided much help in forecasting weather. The cloud mosaics received from the weather satellites by facsimile are not used generally in airline weather offices today, except as a guide to the positions of offshore frontal systems which may affect weather at terminals. The locations of Pacific typhoons and Atlantic hurricanes, as photographed by satellite, are however of vital interest to the National and Military Weather Services, on whose advisers the airlines depend in planning diversions from affected airports. New satellite techniques now under development will probably have greater application to the airlines in the years ahead. The capabilities of establishing temperature fields through infra-red instruments, of converting cloud motions

Though much has been said about satellite meteorology's contribution to weather forecasting, this new tool has not as yet contributed significantly to airline meteorology. Inertial navigation shows far greater promise of helping to improve airline performance

to upper-air wind patterns, of distinguishing major thunderstorm developments from large-scale cloud systems, all have a potential for operational usefulness in the airline picture. For the oceans and sparsely populated areas of the globe where upper-air data-gathering networks are not feasible, these new techniques have great significance.

A new tool of the aviation meteorologist, just appearing on the horizon, is the inertial navigation system now guiding some 150 airline aircraft. In addition to providing the exact latitude and longitude of the aircraft at any instant, I.N.S. gives a frequent readout of the wind direction and speed being encountered (possible because an aircraft with I.N.S. is as well "fixed" as a ground station). From this source, meteorologists and flight crews have already learned about fine-scale wind structure in and out of jet streams and in thunderstorm environments, to a degree that has heretofore been available only to a few research aircraft equipped with special gear.

Now we have, in effect, a fleet of research aircraft operating around the clock over many air routes. It should give us new insight and operational weather data that will permit the refinement of wind forecasting and help us in anticipating some turbulence conditions on a scale matching the phenomenon (for which the established data-gathering system is too coarse-meshed to see the details we need). The diagram above shows the kind of knowledge of wind structure now made possible with I.N.S. To appreciate what this means, note that the conventional wind-measuring system now used worldwide consists in tracking balloon-borne radio transmitters released from ground sta-



Shown above is a plot of winds measured aboard a Boeing 747 fitted with an inertial navigation system, on a flight across Nevada and Utah at 37,000 feet. Winds were logged every two minutes (i.e. at intervals of about 18 miles)

through a jetstream core. The rawinsonde stations in this area are at Ely, Nevada (the central black circle) and at the points marked R, and would be the only conventional sources of wind data.

tions spaced on irregular grids 100 to 300 miles apart. (And this grid density applies only to the United States and Europe; in other areas it is even sparser.)

To fully capitalize on this feature of I.N.S., a high-speed data link will be coupled to the aircraft's wind sensors, to its sensitive ambient air temperature indicator and to its flight-recorder accelerometer. Testing of this air-to-ground data link is already in progress. If S.S.T. operation requires the sensing of additional weather elements, this can be accommodated, and the data transmitted to government and airline analysis centers for both research and operational use.

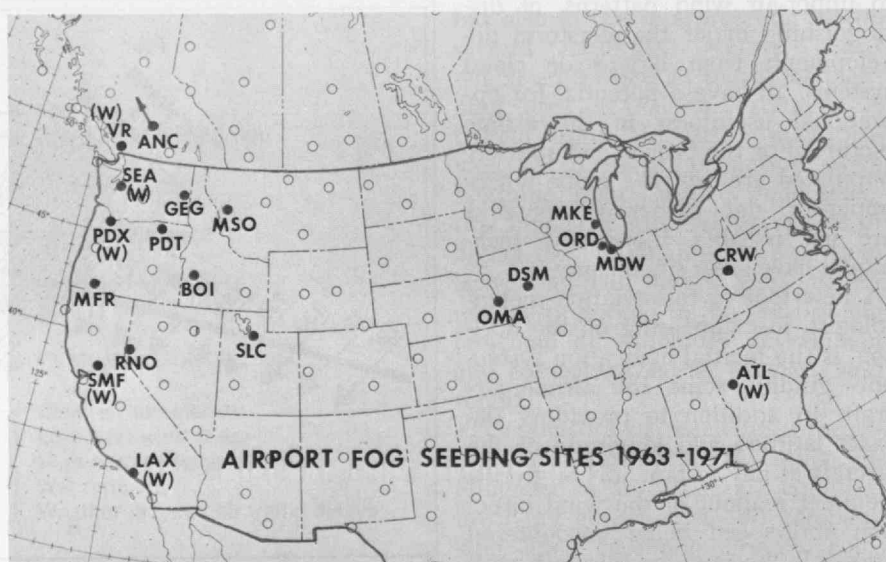
On the subject of S.S.T. operations: how will the task change when airliners travel three or four times as fast as they do now? The airline meteorologist and dispatcher will be concerned with accurate temperature, thunderstorm and turbulence forecasts for flight planning during the climb, trans-sonic, cruise and descent regimes. This requirement should actually be less difficult to fulfill than today, because of the new observational tools under development, including the S.S.T.'s themselves as observing platforms and transmitters of real-time data.

As with any new generation of aircraft, operating experience will quickly give meteorologists a better

understanding of the synoptic patterns involved, and a chance to refine the necessary forecast tools. It will not be necessary to start the S.S.T. support function from scratch, for operating and weather data are already available from high altitude government research projects, supersonic flights of the B-70 and the first two Concorde, and presumably from the extensive flying which has been logged by heavy supersonic military aircraft. At the terminal, weather problems will be the same as they are for the subsonics, except for relief that may be provided by Category III landing aids (to which we shall return) and by future fog dispersal systems.

In other words, future changes look to be of the same order as those of the past. Basic meteorological knowledge and observational techniques have advanced significantly in the past 30 years, resulting in greater skill in forecasting the broad features of the weather patterns over 24- to 48-hour periods. But the detailed short-range forecasts of some "mesoscale" weather phenomena of interest to the airlines (see, again, the first table) still entail a mix of art and science, and do not match the progress that has been made in other areas of technology. To overcome this deficiency, constant monitoring of new data and updating of forecasts is required, and this is where the specialist airline forecaster fits into the picture. Fortunately, some important weather elements affecting operations can be anticipated with a sufficient precision to reduce disruption of schedules and to maximize operating profits without sacrificing safety.

To see how these diverse problems are handled, let us look at them one by one.



The map shows airports where fog-dispersal programs sponsored by airlines and airport managements have been operated in the eight winters from 1963

to 1971. Sites labelled (W) have had warm-fog dispersal programs; the others have used only supercooled-fog-seeding techniques.

Fog—and Its Dispersal

In the populated latitudes of this planet, fog is the greatest obstacle to uninterrupted airline service, and has posed problems since the first days of air transportation. Despite the progress which has been made towards making "all weather" landings possible, fog is estimated to cost the domestic airlines annually about \$75 million, and this cost increases every year. We hear much of Category II and Category III landing capabilities (meaning, respectively, ability to land in runway-light visibilities of 1600 ft. and 800 ft.) but, although millions of dollars have been spent by the federal government and the airlines in instrumen-

tation, maintenance, and training over a period of several years, only 20 runways in the 48 contiguous states were equipped in December, 1971, with Category II hardware. The fully automatic Category III capability is still down the road, and there are reservations among airline meteorologists and some pilots as to how well the system can handle certain other weather factors than fog, such as low-level wind shears (wind variations with height).

Forecasting fog conditions down to very low visibilities is a frustrating task, because of the natural variability of fog density. An electronic measure of atmospheric transmissivity called Runway Visual Range

Fog, snow, and freezing rain are the prime causes of airport shutdowns, and of these only fog has thus far proved susceptible to modification. The forecasting problems have more to do with timing and details than with overall prediction

Station	Fog type	Seeding flights	Per cent success	Cost	Benefit	Benefit/cost
Los Angeles	Warm	25	32%	\$63,000	\$129,790	2.1
Seattle	Warm	12	75%	\$34,500	\$ 96,481	2.8
Salt Lake City	Cold	17	59%	\$ 5,800	\$ 63,650	11.0
Spokane	Cold	63	66%	\$ 4,000	\$ 28,141	7.0
Medford, Ore.	Cold	19	84%	\$ 1,200	\$ 14,970	12.5
Boise, Ida.	Cold	1	100%	\$ 2,600	\$ 2,157	0.8
Omaha	Cold	2	50%	\$ 2,300	\$ 2,988	1.3
Des Moines	Cold	1	100%	\$ 300	\$ 1,793	6.0
Atlanta	Warm	(No Fog)		\$ 4,600		

This table shows the costs and benefits of fog-dispersal operations conducted by United Air Lines alone at nine of the

sites shown on the map (opposite) during the 1969-70 winter season.

(R.V.R.) is now used in the control of landings and take-offs at most major airports, but techniques have not yet been developed for reliably forecasting it. The airline or government forecaster has discharged his responsibilities within the state of the art when he has accurately forecast the time when a fog development will reduce visibility below $\frac{1}{4}$ mile. But this condition does not necessarily close the airport to landings and take-offs, since the R.V.R. value takes into account the fog-penetrating power of the high-intensity approach and runway lights (this measure is the basis of the above visibility figures for Categories II and III). The R.V.R. reading, usually trans-

mitted to the aircraft on initial approach, gives the pilot a conservative indication of where he will first recognize the guidance lighting system, even though the conventional (eyeball) meteorological visibility is being reported as a lower figure.

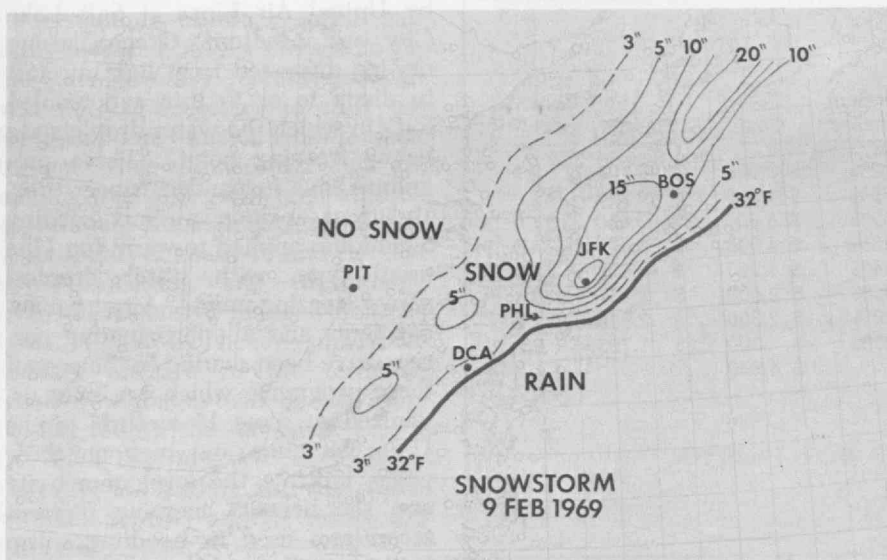
The difficulty of forecasting dense fog conditions, and the costs of Category II and Category III programs, have worked together to cause the airlines to take a new approach to low-visibility landings—fog dispersal. Following several false starts in thermal techniques, which originated as emergency measures in World War II, the most recent era of airport fog dispersal began in 1963. Operational programs were initiated

by United Air Lines at Salt Lake City and Medford, Oregon, using dry-ice dispersed from light aircraft to dissipate or to thin supercooled fog (in which the water droplets are below freezing point). These programs have expanded since then, and now include aircraft seeding techniques applied to warm fog (the usual type, with water droplets above freezing-point). Airport managements and all participating carriers have been sharing in the cost of these programs, which are now organized at some 15 airports in the U.S. The table and map on these pages indicate the level of activity and the benefits accruing. Present techniques used in handling warm fog are still in the developmental stage and are expected to grow into more sophisticated ground methods of fog control, now being tested.

Snow and Freezing Rain

Next to fog, snow and freezing rain are prime causes of airport shutdowns—sometimes lasting longer than stoppages due to fog. Most major airports in the snow belt have been periodically buried for a day or more by a single snowstorm which has defied all the forces of modern snow removal equipment. Ice storms are more localized, but if continuous, can nullify the most efficient sanding operations and ground any aircraft which have not been protected by hangars. Such weather situations leave the airlines with no choice but to prepare elaborate plans for diversions from affected areas as far in advance as the skill of the forecaster will allow.

The synoptic patterns which produce heavy snows or long periods of freezing rain are well recognized. The difficulty is to predict the details. The timing of the onset of



The East Coast storm of February 9, 1969, was an example of an occasion when heavy snow paralyzed some major airports in the Northeast while the same meteorological conditions produced

only rain a short distance away. In such a situation an error that is small by any ordinary forecasting standards becomes crucially important to an airline operator.

snow, its duration and accumulation, and the direction and speed of the accompanying winds, are very difficult to anticipate with the desired accuracy. The snow/rain line associated with some major cyclones is critical: an error of only 50 miles in the forecast movement of a low-pressure center—a small error by forecasting standards—has meant the difference between rain and 30 inches of snow at a particular airport (an example is shown above). Here is where improved mesoscale forecasting capability would pay off handsomely.

Thunderstorms

Thanks to the development of

ground and airborne radar, the thunderstorm is less formidable an enroute weather problem today than even 20 years ago. An aircraft encounter with damaging hail is a rarity, and may be written off as an airline hazard.

Flights are planned to go around or over anticipated areas of severe thunderstorm. Doing this depends on good forecasts. Most airlines use the severe-weather advisories of the National Weather Service as a starting point. Issued from a special office in Kansas City known as the Severe Local Storm Unit, these forecasts are piped to airline weather offices by teletype, relayed as required to flight dispatching offices and to specific

flights by radio-phone connections, and supplemented by hourly aviation reports and ground radar summaries. The newest tool, first tested by the airlines in the summer of 1970, is a facsimile hookup to the National Weather Service ground weather-radars. This provides the airline dispatch offices or weather centers with a nearly instantaneous scope display of the current position and intensity of thunderstorm activity, which is the information they need for flight planning.

But thunderstorm patterns change rapidly, individual cells growing and decaying in only 20 to 30 minutes. When complete avoidance of storm lines cannot be accomplished by choice of flight plan, the key tool to a safe and smooth ride is the aircraft's weather radar. The newest radars now being mounted on the 747's, DC-10's and L-1011's have 300-mile range, twice that of their precursors. This gives the pilot ample time to survey a line of thunderstorms from a distance for soft spots through which he can fly—using eyesight when he reaches them—or "saddles" in the buildups which he can fly over, with a minimum of detouring. The Air Route Traffic Control (A.R.T.C.) Centers of the Federal Aviation Administration (F.A.A.) are also kept current on thunderstorm location and intensity from the same ground sources, from their own radars, and by feedback from flights they are controlling.

Of course, no departure from planned altitude or route for detouring thunderstorms can be made by any aircraft without prior clearance from A.R.T.C. Congestion around major air traffic hubs has recently resulted in occasional refusals of such clearance because of insufficient airspace. Aircraft are

Thunderstorms and high winds present hazards to modern aircraft chiefly during landing and take-off. Otherwise these features are now reduced to economic issues having to do with payloads and fuel consumption

then forced to hold, divert to an alternative destination, or—as has happened in a few cases—to negotiate corridors narrower than is prescribed for maximum turbulence avoidance.

This problem is likely to be alleviated with the help of improved ground radar communications and display through the new F.A.A. Central Flow Control Facility, (C.F.)², and of improved airborne radars which will depict the actual zones of turbulence; both developments already under way.

In the terminal area, thunderstorms cause sudden gusty windshifts which may be a hazard for the unwary at landing or take-off. This is a transitory weather element, precise timing of which is critical, but unforecastable more than a few minutes ahead of time. Pilots and control personnel using the airport's own meteorological equipment can normally keep ahead of this hazard, but additional instrumentation on the airport periphery would give added guidance. Occasionally a cluster of severe thunderstorms centered over an airport may cause a suspension of aircraft operations because of not only strong winds, but hail, lightning and heavy accumulations of water on runways.

Strong Crosswinds

Modern jet transports are allowed to land on a dry runway in winds whose component across the runway is up to 30 knots. Most airports served by air carriers have a runway complex giving a choice of directions, allowing landings to be made in surface winds whose total speed is substantially higher than this. On the other hand, when braking effectiveness is reduced by runway "clutter" (such as standing water, slush, ice,

or packed snow) the allowable crosswind may be reduced to only 5 knots. This kind of restriction can close an airport, or at least reduce its capacity. For the meteorologist, the forecasting problem then becomes one of anticipating not only the strength and direction of the wind, but also the impact of runway clutter on its allowable cross-direction maximum. A particularly critical case is the snowstorm with strong winds. The forecaster must not only try to estimate the accumulation of snow and when it will end, but also in what direction the wind will hold when the snow has ended (since most airports have only sufficient snow-clearing equipment to attack and hold open one runway at a time). Even with proper planning, the economic impact of a combination of strong winds and poor runway conditions can be substantial, as airport capacity is reduced and wholesale cancellations, diversions, and delays ensue.

Headwinds and Tailwinds

Between climbout and descent, the situation is different: the effect of the winds encountered is almost entirely an economic one. In earlier days, with shorter-range aircraft, a poor forecast of headwinds might result in unscheduled landings and extensive delays. Today, in contrast, any wind can be handled, but at a price in fuel or payload; and this too is planned in advance of the flight. If wind forecasts are consistently poor, the pilot and dispatcher will logically begin to ask for more fuel than is called for in the flight plan, to ensure an adequate margin. This is an expensive practice, for today's jets with their thirsty appetites consume up to 30 per cent of the excess fuel simply to carry it. More im-

portant, under some operating conditions, without proper forecasting and planning, payload may be restricted, to accommodate the additional fuel weight. Thus, a large portion of the total effort of an airline weather office is devoted to ensuring that the flight planning computers have the most accurate upper-air wind and temperature forecasts that present-day techniques can provide.

Most airlines use the output of the CDC 6600 computer at the National Meteorological Center in Washington. The observations upon which the 6600 relies come from about two hundred rawinsonde (balloon) stations around the world, and from hundreds of airline and military flights operating over the air routes over both populated and unpopulated regions. Wind and temperature forecasts covering most of the Northern Hemisphere are fed through dedicated phone lines either directly to the airline computer or to the airline weather center for further processing. This government service avoids many man-hours of duplicative effort by the airline meteorologist.

The mathematical model which the 6600 uses falls short in winter and early spring, when almost explosive changes in wind and temperature patterns and peaks in jet-stream velocities occur which elude the forecast system. The forecasts therefore need considerable updating and revising by the airline weather departments, based on the constant flow of up-to-the-minute wind and temperature information they receive from aircraft.

Since direct operating costs for an average airline aircraft are about \$500 per hour, keeping the flight-plan winds refined to the utmost contributes to fuel savings running

into many millions of dollars annually.

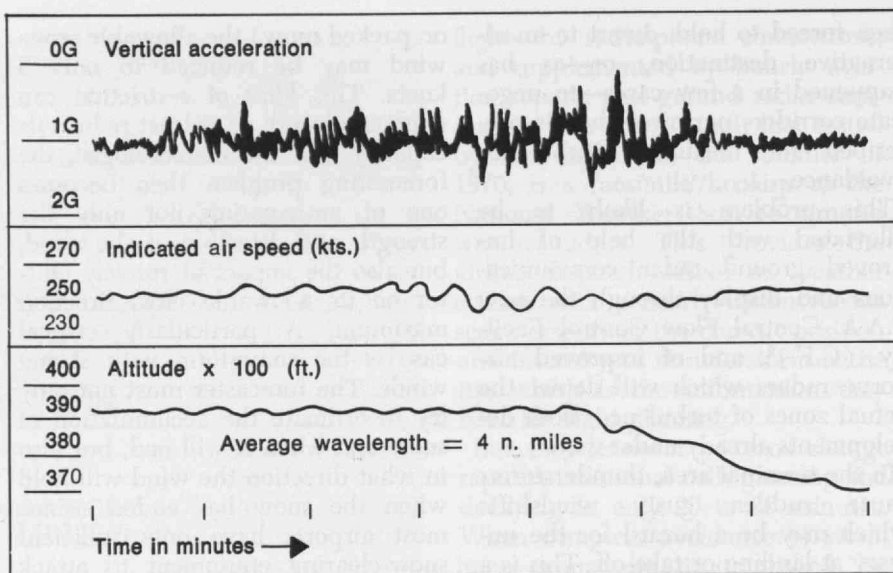
Flight plans are printed out by the airline's computer two to three hours before departure time. Several such plans are computed for each flight, and reviewed by the meteorologist and dispatcher to discover which of them best meets all criteria.

Flight plans were first made by computer in 1954 by United Air Lines, using hand-generated wind forecasts and an IBM 607. Today's machines produce as many as 1000 flight plans per day, encompassing, if required, all of the Northern Hemisphere and much of the Southern.

Clear Air Turbulence

The cautionary advice given to passengers on every airline flight about keeping their seat belts fastened while in cruise recognizes the inherently spotty nature of Clear Air Turbulence (CAT) and our inability to forecast the precise time and location of this potential hazard. The frequency of encountering "severe" CAT (arbitrarily defined as producing vertical accelerations of plus or minus 1.0 G) is about once in 35 million miles of flying—even the veteran air traveler experiences such an event on scheduled airlines perhaps once in a lifetime, if he confines his travels to scheduled airlines. But these same airlines fly approximately four million miles every day in the U.S., and at this rate, the air carrier fleet is vulnerable to severe CAT three or four times per month (mostly during winter and spring). The exposure would be greater were it not for a capability of forecasting general areas within which some CAT may be expected, and flight-planning to avoid it.

Airline meteorologists developed



A case of WIT (Wave Induced Turbulence). Trace of accelerometer reading, indicated airspeed, and altitude, obtained from a DC-8 aircraft flight recorder. This seven-minute record has been magnified 20X from the original record etched on a spool of stainless steel. The vertical gusts indicate a turbulence encounter corresponding to "mod-

erate" intensity. This even occurred in clear air at the tropopause. Wave action is evident on the airspeed and altitude trace and can also be recognized above the "noise" of the vertical gusts. Descent from 39,000 feet to 35,000 feet was started between the fourth and fifth minute as a WIT-avoidance measure.

the first CAT forecasting techniques in 1956, using synoptic analysis plus aircraft reports of actual turbulence. Refinement of the forecasting methods has continued, and in recent years we have made effective use of the acceleration recorders aboard the aircraft in learning more about the nature of the beast. Shown here is a typical recorder readout which illustrates the mesoscale nature of the phenomenon (the whole trace represents only about 50 miles of flight). It is obvious that we can never effectively forecast all CAT areas with synoptic-scale data. So an airborne CAT-detector must eventually be developed, to provide the same kind of guidance to the pilot as

airborne radar does with respect to thunderstorm turbulence. Prospects seem hopeful, on the basis of recent government and university research with ground radars, hydrodynamic simulations of the atmosphere, and concerted flight research using several fully instrumented aircraft. Also, very recently, a mathematical theory has been developed whose predictions of turbulent air motion tally with observations.

Incidentally, the acronym "CAT" has been falling into disfavor among some meteorologists. The phenomenon of practical interest is really the turbulence, whether it occurs in clear air or cloud. Because airline meteorologists, pilots and research-

News accounts occasionally remind us of the surprises which clear air turbulence still holds for airline passengers. But these events would be far more frequent without the largely successful forecasting techniques now in use

ers all recognize wave motion at many wavelengths as an ever present characteristic of this kind of turbulence, either as a triggering mechanism or as an accompaniment, the expression "WIT" is being promulgated—Wave Induced Turbulence.

Low-Level Wind Shear

In the few hundred meters of air next to the ground, stratification sometimes develops which causes the winds to change abruptly in speed, direction, or both, within a small vertical distance. When aircraft have descended through the shear layer on approach to landing, this "wind shear" has been responsible for undershoots, overshoots, hard landings, or worse. At least one case has been measured of a 30-knot speed change in 30 meters, but the shear need not be this great to compromise safety. Fortunately, the general synoptic conditions can be forecast.

Even so, airports possess no observational technique at present for furnishing the actual magnitude of the shear to incoming aircraft. This kind of data is becoming increasingly important, to ensure the safe landing of large aircraft from the "decision altitude" of 100 feet which is specified in the category II bad-weather-landing requirements.

High Surface Temperatures

Today's jet airliners are significantly affected, with regard to fuel requirements at take-off, by surface temperatures. The objective is to minimize payload penalties. Although it is the higher air temperatures which most significantly affect air density and hence length of take-off run (particularly at high altitude airports), the flight dispatcher is con-

cerned also with temperatures in the moderate range. The airline forecaster must therefore exercise his skills in developing the hour-by-hour expectancies of temperature at all seasons, so that permissible gross weights for marginally short runways, under different wind conditions, can be calculated.

Some attempts have been made to computerize this type of forecast, using climatological data and currently reported values. But corrections required to account for changes in local circulation, passage of fronts, and other factors are too subjective to program, and today manual systems still produce the most effective results.

Wet Runways

At the landing speeds of today's transports, standing water remaining on the runway during or following rain or from melting snow may cause hydroplaning of the aircraft tires, reducing braking action after landing to nil. This problem is influenced more by the runway's surface characteristics and drainage than by the purely meteorological factors that govern other forms of runway clutter. It is now established that a grooved surface helps a great deal.

Recognizing that reverse thrust is most effective only at the higher ground speeds, and that wheel braking cannot always be effective on wet runways that are not grooved, regulations require additional runway length to be available for use when wet. Lacking this additional braking distance, safety requires the offloading of payload or fuel. Thus, the meteorologist has a role here: the accuracy of the precipitation forecast is obviously related to both economics and safety.

In General: Weather Delay

Until airways and airport capacities began to be taxed to their limits by traffic volumes that grew faster than the ground and control facilities, airline flights were not delayed or interrupted except when they were directly confronted by a deterring weather problem. Today it is a different story. Enormous costs are incurred by the airlines when air traffic becomes backed up half a continent away from an airport affected by fog, snow, crosswinds, or a stagnant thunderstorm condition. The source of trouble need not be an airport: similar delays are triggered long distances from an airspace block where there is severe thunderstorm activity or extensive wave-induced turbulence.

The problem of anticipating and minimizing these types of delays rests largely with the flight dispatcher and the air-route traffic controller; their judgment is significantly enhanced by timely forecasts from the airline or government weather offices.

Solutions to the overall problem of delays caused by weather are complex, involving both government and industry efforts to modernize communications links and weather and control radars, and to further computerize air traffic control procedures. The establishment of the first Central Flow Control Facility by the F.A.A., already mentioned, is one of the steps being taken to ease the situation.

Industrialized Housing and Public Policy

In the 1968 Housing and Urban Development Act, Congress dedicated the federal government to the attainment of the 1949 goal, which has not been met, of a decent home in a suitable living environment for all families. This goal, says the Act, "can be substantially achieved within the next decade by the construction or rehabilitation of 26 million housing units, 6 million of these for low and moderate income families." That latter figure is not unfamiliar. John W. Gardner, in the Committee on Science and Astronautics' *Science, Technology and the Cities* (1969), puts it thus: "... after two generations of agitation and amid the greatest physical abundance in the history of the world, the nation still tolerates 6 million substandard dwelling units and almost 4 million more that, while physically adequate, are overcrowded."

Although, in the Act's Declaration of Policy, Congress made it clear that "the highest priority and emphasis should be given to meeting the housing needs of those families for which the national goal has not become a reality," specific means to this end were not provided. To be sure, innovations such as Title II sections 235 and 236, which enable the Federal Housing Authority to assist low and moderate income families to purchase and rent (respectively) housing through direct subsidies, are steps toward this goal. But nowhere in the Act do we find the methods whereby H.U.D. might be able to expand the supply of housing at costs low enough to allow low- and moderate-income people to participate.

*The author gratefully acknowledges the assistance of Ernest Bohn and Douglas Montgomery, both members of the C.W.R.U. faculty.

And the ten-year goal for new units requires that an average of 2.6 million units be created each year, 1.1 million more than this country's recent average production. It is being said that the housing industry is entering boom times. According to *U.S. News & World Report* (March 8, 1971) the drop in mortgage rates to 7 to 8 per cent, an ease in the fear of recession, and revived consumer interest in frill-free houses with price tags in the mid 20,000's encouraged officials to predict a big sales year. The chief economist for the National Association of Home Builders foresaw 1.8 million units, but this is still far below the goal.

Operation Breakthrough (O.B.), announced by H.U.D. Secretary George Romney in May, 1969, is the administration's program for the needed technical improvement in methods. It aims to encourage new technology, use the full range of available labor skills, improve architectural design and site planning, reduce rising costs, overcome constraints imposed by building codes, zoning laws, and labor rules, encourage better methods of financing, improve management, and identify and aggregate larger markets to provide greater opportunities for volume-produced housing systems. In short, it is a program to develop, test, and promote industrialized building in housing. In this article I shall describe the program, and then attempt to evaluate it in the context of possible alternatives.

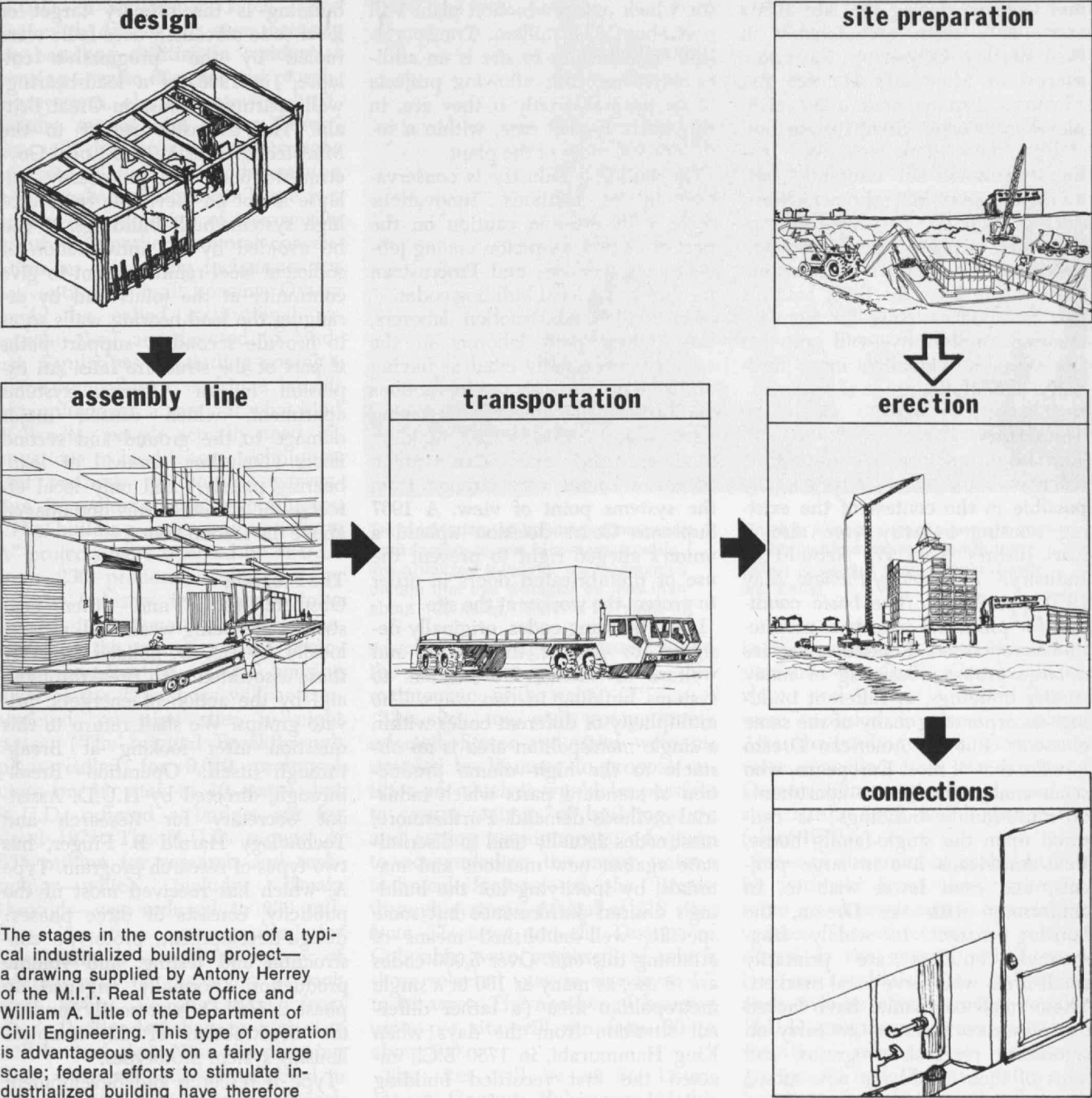
First, it is necessary to say a few words about industrialized building in general. After World War II, Western Europe experienced acute shortages of housing, material, and skilled labor. In an attempt to acquire enough new housing in the shortest possible time, several coun-

tries subsidized companies anxious to develop new building technologies. This research and development led to new construction methods that employ various amounts of factory-produced parts, all of which methods are known as industrialized or systems building.

Systems building offers several advantages over conventional building. The use of unskilled and semi-skilled labor in the factory and on the site enables the contractor to avoid dependence on expensive craft laborers. The mass production of building parts in the factory enables the contractor to realize a higher level of productivity from his laborers than is possible with traditional methods on the site. The time required to construct a building with systems methods is usually only 50 to 66 per cent of the normal time, another source of cost savings. New building materials are used which could not easily be handled by conventional building methods. Systems building also permits the integration of building functions, from initial design to completion (in marked contrast to the conventional disorder) making the construction process more predictable. Overall, the estimates of cost saving range from none to 25 per cent.

Although systems building techniques have been used for many kinds of structures beside housing complexes—schools, dormitories, hospitals, clinics, and office buildings—the systems approach to housing has been challenged by some architects on aesthetic grounds. In fact, the artistic quality of systems-built structures varies at least as widely as that of conventional buildings. Many low-income projects erected by traditional methods in New York

H.U.D.'s Operation Breakthrough promises to stimulate the acceptance of industrialized building, and in the process to erode many of the institutional obstacles to low-cost housing. But the central task has yet to be tackled



The stages in the construction of a typical industrialized building project—a drawing supplied by Antony Herrey of the M.I.T. Real Estate Office and William A. Little of the Department of Civil Engineering. This type of operation is advantageous only on a fairly large scale; federal efforts to stimulate industrialized building have therefore attempted, among other things, to overcome the geographical barriers of local building codes.

Building innovations encounter extreme caution on the part of clients, suspicion among job-conscious workers, and Procrustean rigidity in the local building codes

and Chicago during the late 1950's and 1960's seem unmatched in their sterility. Conversely, the visual success of Montreal's Habitat and Finland's Tapiola, and other complexes in Sweden, Great Britain, and Italy, provide some assurance that the systems are not inherently anti-aesthetic. Ezra Ehrenkrantz, President of Building Systems Development Inc., San Francisco, and *Engineering News-Record's* Construction Man of the Year for 1969, believes that building systems—far from increasing uniformity—will provide for more individuality, more flexibility, and a fuller range of options.

The Barriers

This bright picture begins to fade when we ask what is practically possible in the context of the existing housing industry (see also J. Karl Justin's "Can We Rebuild an Industry?" *Technology Review*, May 1970, pp. 22-29). The basic condition for profitable industrial production is repetition. Repetition implies a large project consisting of many similar buildings, or different buildings incorporating many of the same elements. But the American Dream (unlike that of most Europeans, who seem content to live in apartments or multi-family buildings) is centered upon the single-family house. Few Americans live in large projects, and even fewer wish to. In conformity with the Dream, the housing market is widely fragmented; builders are primarily small firms who serve local markets. These small companies have lacked the resources necessary to carry on significant research programs, and most of them could not now afford the investment of a systems building factory. For example, Associated Estates, in Cleveland, has a system

for which one production plant will cost about \$2.5 million. Transportation from factory to site is an additional major cost, allowing projects to be profitable only if they are, in this fairly typical case, within a radius of 100 miles of the plant.

The building industry is conservative in its methods. Innovations meet with extreme caution on the part of clients, suspicion among job-conscious workers, and Procrustean rigidity in the local building codes.

The skilled construction laborers, the highest paid laborers in the country, are usually cited as having obstructed, through court actions and strikes, the use of labor-saving devices and industrialized building methods. And truly, some union successes sound very strange from the systems point of view. A 1967 Supreme Court decision upheld a union's alleged right to prevent the use of prefabricated doors in order to protect the worker at the site.

Local building codes, originally designed to protect the health and welfare of clients, are barriers to systems building in two ways. The multiplicity of different codes within a single metropolitan area is an obstacle to the high-volume production of standard parts which industrial methods demand. Furthermore, most codes actually tend to discriminate against new methods and materials, by specifying not the building's desired performance but some specific, well-established means of attaining this end. Over 5,000 codes are in use, as many as 100 in a single metropolitan area (a rather different situation from the days when King Hammurabi, in 1750 B.C., enacted the first recorded building code, decreeing death for an architect whose house fell on a client).

The structural adequacy of systems

building is the primary target of local code officials, whose fears were fueled by the "progressive collapse," in 1968, of a load-bearing-wall apartment house in Great Britain. The extensive report to the Minister of Housing and Local Government found that progressive collapse is not an inevitable feature of high systems-built buildings. It can be avoided by the introduction of sufficient steel reinforcement to give continuity at the joints and by arranging the load-bearing walls so as to provide secondary support paths if part of the structure fails. An explosion in an Algerian systems apartment, which caused major damage to the ground and second floors (including removal of load-bearing panels), had only local effects—the structure was undamaged above the second floor.

The Program

Obsolete codes and other constraints are being weakened, at least locally, by H.U.D. policies (notably those associated with Breakthrough) and by the action of energetic private groups. We shall return to this question after looking at Breakthrough itself. Operation Breakthrough, directed by H.U.D. Assistant Secretary for Research and Technology Harold B. Finger, has two types of research program. Type A, which has received most of the publicity, consists of three phases: design-development, prototype construction and testing, and volume production. Formally engaged in phase 2, H.U.D. is presently funding the construction of 22 complete housing system prototypes.

Type B research and development is aimed at longer term projects. Eleven proposals have been selected from among the 385 submitted to

H.U.D. in September, 1969. Three deal with developing new methods for handling utilities in residential housing—waste disposal and plumbing systems, electrical power distribution, service and utility “cores.” One will develop a new lightweight concrete mixture suitable for casting into panels and modules. There is a project on the design of inexpensive furniture. Another proposal concentrates on cost-saving techniques for conventionally built housing. Others might be called institutional research: they are devoted to land-use regulations (including zoning), home-ownership as a fringe benefit of employment, a study of what kind of housing people actually need, innovations in land-tenure techniques, and methods of market aggregation for volume housing producers.

The building systems of the “type A” projects were selected by H.U.D. from 236 proposals submitted by private industry in response to a formal invitation issued in June, 1969. In the second phase—prototype construction—2,000 housing units of the 22 systems will be constructed, on nine sites in eight states. (The original Breakthrough plans called for 3,000 prototype units on 11 sites in 10 states, but H.U.D. suffered a budget cut for fiscal 1971. The H.U.D. request of \$55 million for research and technology—which includes Breakthrough—was reduced to \$30 million, less than was required for Breakthrough alone.) A variety of systems will be displayed at each site. Every housing type, from single-family detached to high-rise, will be included. Nine site-planning firms were competitively selected to integrate the housing types at each site into an attractive living environment. Private developers were also



Transportation of building components from factory to site is a major cost in industrialized building; the economics dictate that this distance be less than about 100 miles. There is no point in

building a factory unless enough compatible work is planned within that radius to keep it busy. (Photo: Levitt and Sons)

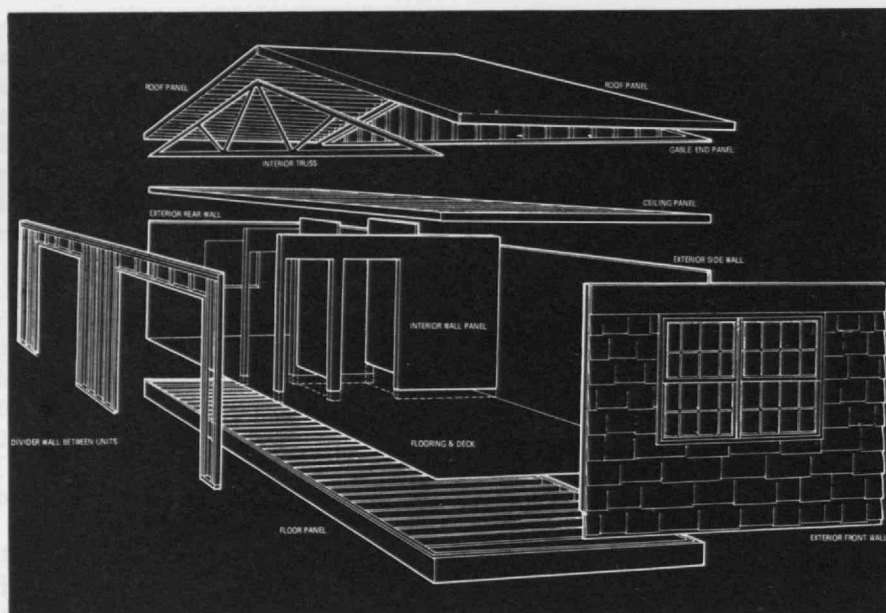
selected to manage construction and the subsequent sale, rental, and maintenance of the units.

The sites, too, were competitively selected. States and cities were instructed by Romney to propose entities on which it would be possible to secure waivers of building-code and zoning requirements, adequate to accommodate the many unique technical features of the Breakthrough systems. A total of 218 sites from 37 states and the District of Columbia were proposed, of which those selected vary in size from 1.7 to 60 acres. The number of housing units per site will run from 80 to about 500.

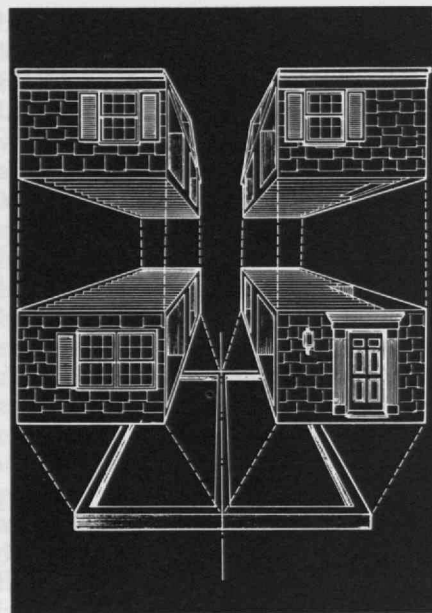
The sites will be in St. Louis; Macon, Georgia; Kalamazoo, Michigan; Sacramento, California; Indianapolis; Jersey City; Memphis; and 2

in Metropolitan Seattle. Originally, sites in New Castle County, Delaware, and Harris County, Texas, were included in the O.B. plans. After the funding cut, however, they were cancelled from the program. Construction, originally planned to start late in 1969, was begun in the fall of 1970.

Some of the units at each site will be withheld from the market to serve as demonstration models for visitors. The others will be sold or rented to the general public on a free market basis. Financial assistance will be offered under regular H.U.D. programs, to ensure a representative mixture of economic groups. An open housing policy will be pursued. H.U.D. will follow up the experiment by checking on the reactions of residents and the dura-



Drawings show how the components of one Levitt system, used in an Operation Breakthrough project, fit together into a housing "module", which can be combined with other modules to form a complete building.



bility of the structures.

While some proprietary systems were already complete before Breakthrough (and will receive from it a commercially useful boost) others will need a considerable development effort to achieve a perfected operation, and H.U.D. will pay the research and development costs. Because of the prototype nature of these developments, and because each producer is assigned only a small number of units on each site, construction costs are expected to be greater than they would be in full production. H.U.D. will make up the difference between sale prices and construction costs.

The major effect of the development subsidies has been to attract

industrial corporations which had system capabilities but little or no experience in housing. At the same time, small firms could participate in the program by forming consortiums or by becoming developers, builders, and suppliers to the volume producers.

The testing of the prototypes will lead to a certification of each system by H.U.D. (which is being aided in this work by the National Bureau of Standards and the National Academies of Science and Engineering). The idea here is to provide some credible guarantee that a new method of building is trustworthy, for the benefit of those who might otherwise insist on the letter of their local codes. "It is hoped that

the H.U.D. certification will afford adequate assurance to the local elected officials and building code officials as to the safety and soundness of the housing," says one H.U.D. document.

On this matter of transcending the local codes, the federal government is not alone in its thinking. In the past two years, California, Ohio, Washington, and Virginia have passed legislation under which the state evaluates and certifies industrialized systems, which are then freed from having to meet local requirements. (Ohio's law will probably be challenged by a city and judged by the courts as to its constitutionality.)

As soon as the Breakthrough sys-

For the first time, national unions representing carpenters, electricians, plumbers, and laborers have signed contracts with volume housing producers covering off-site production facilities and the on-site installation of the products

tems are evaluated, and (hopefully) federally certified, their proprietors will be able to seek the volume markets they need to make industrialized building profitable. While H.U.D. does not guarantee commercial success for any of the participants, it is attempting to identify possible large-scale markets and develop them. As information source and packager, H.U.D. is assembling data on available land, sponsors, developers, potential buyers, and sources of funds. H.U.D. is also urging Breakthrough upon real estate and financial groups, homebuilders, and potential purchasers.

While no direct financial support is planned for the volume production of the certified Breakthrough systems, H.U.D. will give priority in the allocation of housing assistance funds (especially the Title II, sections 235 and 236, programs I mentioned at the beginning), to proposals that plan to use Breakthrough systems. Communities that raise no objection to the use of these systems for all income levels will be given priority in their funding requests to H.U.D. for water and sewer facilities, community facilities, and urban renewal financing.

At this point, a H.U.D. departure from original Breakthrough plans should be revealed. Phase 3, the active encouragement of mass construction of housing using O.B. systems, was not to begin until the prototypes were constructed, tested, and officially certified by H.U.D. However, even though phase 2 is behind schedule (at last review no system had acquired certification) H.U.D. is vigorously pushing ahead with phase 3 operations. In the Cleveland area, the Federal Housing Administration (F.H.A.) has already given priority to processing

applications of three projects that will employ O.B. systems. Two have acquired F.H.A. commitment and the third expected F.H.A. approval before the new year, regardless of whether or not the prototypes had received certification. In this manner, H.U.D. is projecting its confidence in the 22 systems and stimulating faster local acceptance of systems building methods.

The preferential treatment afforded systems builders by F.H.A. or other H.U.D. agencies is presently limited to the 22 firms and consortiums participating in the prototype program. Consequently, nonparticipants who currently possess systems capabilities, and who will be analyzed by H.U.D. after formal certification procedures are completed in the O.B. program, are for a while discriminated against.

Other changes are sought through persuasion. One of the causes of seemingly unimaginative site planning is the inflexibility of local land-use regulations. Consequently, H.U.D. advocates—although it cannot implement—the “planned unit development” concept, whereby developers may ignore specific regulations and present their plans to local officials for approval or disapproval as a whole. And local zoning restrictions, especially in the suburbs, may be overruled by state laws such as the Massachusetts statute that authorizes a state agency to review local decisions against inexpensive housing. In California, a group of government and citizen agencies is currently challenging the constitutionality of a suburban zoning law which discriminates against people of low income.

In its written communications, H.U.D. fails to mention that the deleted Breakthrough sites in Dela-

ware and Texas experienced vigorous opposition from local citizens. Both the Delaware site, a suburb of Wilmington, and the Texas site, a suburb of Houston, drew objections from residents convinced that Breakthrough would relocate blacks into their neighborhoods. Finger admits that local opposition delayed progress at these sites and weighted the decision to drop them when the budget cut occurred; he implies that if enough money had been available the battle against prejudice in New Castle and Harris Counties might have gone differently.

Attempts to overcome restrictive labor practices have ranged from Romney's verbal confrontation with union members at the 1969 A.F.L.-C.I.O. Building Trades Convention to friendly persuasion. For the first time, national unions representing carpenters, electricians, plumbers, and laborers have signed contracts with volume housing producers covering off-site production facilities and the installation of units at the building sites.

It should perhaps be mentioned that Finger has his own definition of “technology,” which encompasses not only hardware but any novel means whatever for achieving a specified end result. When he speaks about Breakthrough, he tends to de-emphasize the hardware aspects and concentrate on the institutional changes which he hopes to stimulate. Viewed in this light, Operation Breakthrough is a kind of wooden horse of Troy—a human incursion into the city presented in a physical package designed to appeal to Trojans.

From all of this, we might draw the obvious conclusion that Operation Breakthrough will be beneficial. However, the urgency of our urban

A federal program may be judged according to how well it uses the full range of options available to it—which range from complete inaction to direct subsidy and regulation

problems, the keen competition for public resources, and the complexities of our social, economic, and political environment force the serious student of public policy to compare programs with feasible alternatives and to try to discover whether stated objectives are in fact accomplished.

Compared to What?

Any public policy can be analyzed at several levels. For instance, if we choose to ignore the realities of existing political and economic constraints, any federal housing effort short of immediate and direct federal construction might appear wanting in seriousness and substance. At another level of analysis, we might acknowledge the restrictions of the existing laws and relationships between government and private industry, but acknowledge also the full range of actions open to the federal government; we might then judge a program according to its position along a continuum of feasible activities, of which one extreme is complete inaction and the other is direct federal subsidy and regulation (as we find it in areas such as nuclear power, air transportation, and farming). A third, narrower level of analysis starts by accepting the reigning political philosophy as a constraint within which all programs must operate.

The first level leaves the imagination delightfully untrammelled but offers little practical help. What is possible in one country is not necessarily politically possible in another. The federal financial resources for a really sweeping solution exist, but it is well known that money is not everything. The third level is, for the long-term view, unnecessarily myopic, for administra-

tions come and go with a rather shorter time-constant than that of this particular problem. It is the level on which the officers of an administration presumably wish to be judged, at least while that administration is in power. But I shall incline toward the second, broad-continuum level of analysis, with occasional—and I hope recognizable—excursions into the other two.

The implementation of the 1968 Housing Act was one of the tasks that the present administration inherited from its predecessor; it is a task whose performance depends very much upon how the role of the federal government is regarded.

At the National Governors' Conference in the summer of 1969, President Nixon revealed the New Federalism. He characterized the structure of the federal government as being "overly centralized, overly bureaucratized" and blamed this for "the collapse of confidence in government itself, a mounting distrust of all authority that stemmed in large measure from the increasing inability of government to deliver its services or keep its promises." In contradistinction to the philosophies of Hamilton, Madison, and Jay—whose "old federalism" was intended to restrain the ominous spirit of factional divisiveness—President Nixon desires to give greater control to state and local authorities: the federal government will provide guidelines and money, but not direct services.

Ironically, while the governors generally favored the revenue-sharing plan (the primary outgrowth of the New Federalism) Governor Nelson Rockefeller at the same conference won overwhelming approval for recommendations for greater centralization. Only Lester Maddox

opposed a resolution for Washington to take over the state welfare programs entirely, and all but a handful of the state leaders supported a nationwide compulsory health insurance program. And city majors, while anxious to obtain more federal money and more control over its allocation, are not convinced that they can receive equitable treatment if the funds are filtered through state capitols.

Seemingly impatient with these unproductive local rivalries, *Business Week* (Dec. 6, 1969, p. 130) commented to the effect that, when a problem is national, the action called for is also national: "The abrasions and dangers of the social revolution now central to the nation's cities . . . are beyond the resources of city hall, state house, or any voluntary association of businessmen. Even if the demands of the poor and the blacks could be coped with locally, the end they seek is a national one—a reweaving of the social fabric—and only national leadership will be able to chart a response."

Donald Cantry, who is an advocate of metropolitan decision-making in metropolitan functions (offering economies of scale), claims that if it is necessary to offer localities incentives to induce them to coordinate their planning activities, this is "no time for the federal government to give its carrots away" (*City*, August, 1969, p. 21).

The Humphrey-Reuss revenue-sharing proposal has requirements for states to accomplish governmental reorganization (including metropolitan-scale planning) in order to be eligible for federal allotments.

From the viewpoint of the protectors of minority rights we are afforded a different perspective. It is



An apartment block being built for Operation Breakthrough in Memphis, Tenn., by the Stirling Homex Corp.

argued that the have-nots can rarely get fair treatment locally, for subsidies go to the powerful, not the powerless. Arthur Simon (*Commonweal*, January 22, 1971) reminds us that Title VIII of the 1968 Civil Rights Act prohibited discrimination in renting and selling of most housing. Shortly thereafter in the *Jones vs. Mayer* case, the U.S. Supreme Court declared "All citizens of the U.S. shall have the same right, in every state and territory, as is employed by white citizens thereof to inherit, purchase, lease, sell, hold, and convey real and personal property." With an executive order, President Nixon, in order to implement the 1964 and 1968 Civil Rights Acts, can withhold all federal money from communities that refuse to accommodate blacks on the same basis as

whites or that fail to provide an adequate share of low-income housing units.

But, one way or another, minorities must rely on the goodwill of the majority. Poverty and segregation have not hurt, or even seriously inconvenienced, the vast majority of Americans. Herbert Gans, writing in *New York Times Magazine* (August 3, 1969), draws the somewhat despairing conclusion that under the present structure of American government there cannot be, and there will not be, a real solution to the problem of the cities. As he sees it, the goodwill of the majority is so limited that majority rule itself is the major obstacle to urban improvement.

Thus, there are those who recognize no constraints at all except the

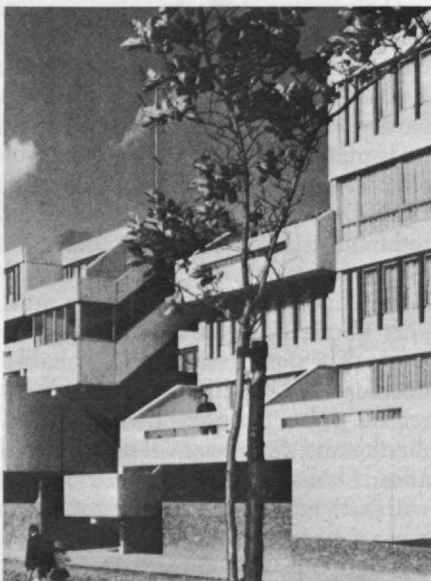
need to solve the problem. And there are also those who recognize all the constraints of their place and time, however transitory.

Romney's greatest success seems to be the identification of constraints inherent in our political structure. What is not profitable must be done by government, and what is profitable may be done by industry. While consciously working within the New Federalist limitations, Romney has created a lucid plan to attack the constraints of local building codes, small markets, zoning, labor problems, and a fragmented industry poor in research and technology. The volume of proposals that the original Breakthrough request evoked clearly reveals industry's new interest in housing, which might lead to the loosening of Congressional purse strings in this area.

The Tasks Remaining

Nevertheless, a serious judgment of Breakthrough, even through the narrow-band filter of the New Federalism, must be based on whether or not the objectives of the 1968 H.U.D. Act will be met. Since a reduction in construction costs of 50 per cent—which is not expected—would reduce the rent of a unit only about 12.5 per cent, and since costs of construction will probably decrease only gradually, there is no reason to believe that low- and middle-income families will be able to afford housing in the near future without additional assistance. For these people, Operation Breakthrough fails. Builders, too, need additional assistance, for few can realistically afford the necessary investments to enter the systems field. (Of course, it is conceivable that those who can may find themselves with a much bigger share of the

If Atomic Energy Commission radiation standards, imposed on states by the federal government, are constitutional, could we not legislate similarly over-riding federal performance standards for building systems?



System building in Europe: work in progress and some of the finished products at Thamesmead, a major new town development in the east of the London metropolitan area. (Photo: Antony Herrey and William A. Little)

market, as appears to have happened in Britain where a few major names show up on one big building site after another.)

A feasible innovation within the New Federalism constraints would be the creation of an Institute for Building Sciences, which could be part of a National Council for Development Standards. With initial government funding, this organization could become self-supporting through collection of fees and subscriptions. Its activities would include the development and updating of building codes, evaluation and certification of building products, equipment, and techniques, the promotion and coordination of research, and the dissemination of information. While endorsed by the Kaiser Committee and proposed by the Douglas Commission, it has been virtually ignored by H.U.D., which plans to take to itself these functions.

Herbert Franklin, Executive Associate of the National Urban Coalition, claims that a generation of experience suggests that the incentive system—that is, federal incentives for new methods, but local control—simply cannot work. In the past, localities have avoided responsibilities by refusing to use federal subsidies that have undesirable strings attached. Franklin, writing in *The Journal of Housing* (August-September, 1969, p. 411) finds it necessary for Congress to *require* that states and localities accept any building system certified by H.U.D. as meeting performance criteria. Jim Toomey, from the same organization, was disappointed by the selection both of systems and of sites. The excitingly different systems were avoided, he said, and the sites were not representative of the inner city environment where the main prob-

lems are.

Escape from the confines of the New Federalism, of course, increases our alternatives. Top of the list is the need for increased federal subsidies. There seems to be virtually complete agreement on one point: systems building cannot decrease housing costs enough to enable low- and moderate-income families to acquire decent housing without assistance. So more housing still means more subsidies. The seriousness of the federal housing subsidy programs of recent years is easily challenged. Between 1962 and 1967, \$356 billion was spent for "defense," \$33 billion for farm support, and only \$1.25 billion for housing subsidies. The Douglas Commission pointed out that almost four times this last amount was, in effect, given to those who already own homes through interest-tax deductions. Even full funding of existing programs would help.

Other direct federal actions are possible. If Atomic Energy Commission radiation standards, imposed on states and localities by the federal government, are constitutional, could we not legislate similarly over-riding federal performance standards for building systems? Additional legislation could diminish the power of unions to prevent the use of certified prefabricated parts on the job site.

One of the cost factors minimally affected by the current thrust of Breakthrough is land, which remains an expensive non-variable tending to keep the sale price of dwellings high, independent of technical progress. The federal government could treat building-land as a national resource. Parcels of land could be set aside for housing, as they are for military bases, space facilities,

research operations, and national parks. The Ragone Panel on Housing Technology recommended that "government should be responsible for having land ready when and as it is needed" for low- and moderate-income housing.

Related to the land resource concept, and not a substitute for increased urban housing construction but a complement, is the idea of starting new cities. The National Committee on Urban Growth Policy recommended in its *The New City* (Praeger, 1969) that by the start of the next century we create a hundred new cities, each housing and employing 100,000 people, and ten others for one million each. New cities constitute ideal projects for systems building in that they provide an opportunity to coordinate all phases of a community's development, and to manufacture components in large quantities. In a new city, many of the obstacles I have mentioned would simply not arise. To plan these cities, and the growth of existing urban areas, some kind of federal urban-growth agency would of course be needed, just as our triumphs in space required the establishment of a Space Administration (from which, incidentally, Harold Finger came).

The Housing Act of 1970, signed January 2, 1971 by President Nixon, authorizes the creation of a Community Development Corporation in H.U.D. Slated to work with state and local agencies responsible for land development, the corporation will coordinate new-town activity. Its aid will include loan guarantees, interest-charge grants, planning grants, infrastructure grants (for mass transit, hospitals, libraries, etc.), and direct grants of surplus federal land. But the authorization

calls for only \$166 million in the first three years, hardly a significant commitment.

Central to the success of Breakthrough is market aggregation. Another route to the coordination of housing demand is metropolitan planning. Housing does not exist in a vacuum. It needs an infrastructure to provide the services people require. So, for housing demand to be concentrated, transportation, education, medical, recreational, and commercial facilities must be planned on a regional or metropolitan basis. As yet, attempts to stimulate metropolitan planning have had minimal results.

The "urban renewal" areas of central cities appear to be natural locations for volume-produced housing. While, as we have seen, the incentive approach includes faster processing of proposals adopting Breakthrough-type housing, more direct federal action seems appropriate. Since the government sells the land at a loss to the developer, the use of building systems could be made a precondition for obtaining such cut-price land.

The research and development programs of H.U.D. seem to have little thrust beyond the prototype stage of the type A projects. The eleven type B projects, while interesting, are disjointed and will have limited effect without additional research. Even though the Breakthrough companies include giant conglomerates such as G.E., TRW, and Boise Cascade, most housing firms still cannot carry on significant research. A continued research program, with increased funding, is imperative.

In conclusion, Operation Breakthrough will have several beneficial effects. Systems building will gain wider acceptance with builders, fi-

nanciers, government officials, and people who need housing. Its expanded use will provide more jobs for the unskilled, plus year-round employment for many construction workers. Also, it will probably, to some extent, increase the supply and quality of housing. But, for lack of commitment in Congress and in the present administration, it will not result in the attainment of the goals so clearly stated in the 1968 H.U.D. Act. Neither Congress nor President have shown themselves willing to provide the funds necessary to complete, according to plan, Operation Breakthrough itself, much less to provide the massive assistance needed by the low- and moderate-income families if they are to obtain decent housing from a price-inflated industry. And in the shorter term, the current New Federalist philosophy, precluding as it does numerous federal actions that would be quite consistent with the existing political and economic environment, sharply reduces the probability of attaining even the modest Breakthrough objective of holding back future cost increases.

Suggested Reading

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New Communities in a National Urban Growth Strategy

An urban growth strategy for the United States must include a three-pronged attack on the problems of the central cities, on sprawling and exclusive patterns of suburban development, and on the sluggish growth or outright decline of depressed regions. Attempts to deal with each of these problems separately are likely to be counterproductive.

For example, efforts to increase housing and job opportunities in the central city seem only to accelerate in-migration of the poor and to perpetuate the existing mismatch between resources and demand for services. Efforts to disperse inner-city residents among existing suburban communities may be a partial solution, but in the long run this is not an effective way to revitalize inner city economies or to rebuild deteriorating areas. Moreover, there is strong sentiment against a "city de-population" strategy that would undercut the recent political gains of emerging black majorities in our largest cities.

Totally new communities (or "new towns" as they are sometimes called) developed within existing urban areas, on open land at the metropolitan fringe, or in rural locations may be the key to an effective urban growth strategy. Development at this bold scale can:

- ☐ Provide significant amounts of housing for low- and middle-income residents in the suburbs, in close reach of new jobs and improved public services.
- ☐ Help spur growth in lagging regions by "making a market" for key services and facilities and by aggregating people and jobs.
- ☐ Revitalize inner-city areas by providing attractive mixed-use development at a scale large enough to have

a disproportionate impact on an entire city.

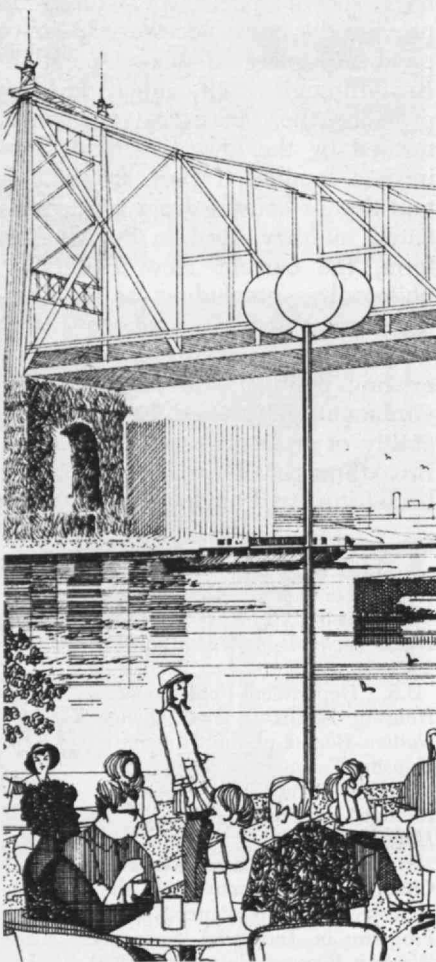
In this article we try to describe various approaches to new community design and development. In particular, we focus on ways of exploiting the innovative potential of a publicly-financed new-communities program so as to reinforce all the policies and programs that will ultimately make up a national urban growth strategy.

Present and Future: A Status Report

At the outset, it is proper to point out that totally new communities (even with ambitious federal financing) could not accommodate all or even most of the U.S. population growth expected in the next decades. For example, the National Commission on Urban Growth Policy advocates the construction of 100 new communities of 100,000 people each and ten larger new cities, each with a population of one million, in the next three decades. This plan might provide accommodation for as many as 20 million people. But there may well be a total U.S. population increase of 70 to 80 million by the year 2000, so new communities (under this plan) would accommodate only a fraction of projected population growth.

If we expect existing cities and towns to accommodate 80 per cent or more of all new growth, why should they not absorb 100 per cent? Why do we need new communities?

There are several reasons: Our biggest cities are already too crowded and terribly underfinanced; "diseconomies of scale" are already all too obvious. Yet the current pace and scale of the market suggests that the largest proportion of new urban growth will be concentrated in only about one third of the 200 metro-



No single program will resolve all of America's urban problems or ensure fulfillment of future inhabitants' needs. But new communities offer an important alternative—and a unique opportunity for social innovation

politan areas in the U.S. Simply multiplying the current development pattern around these areas will increase central-city congestion and further tax its already overburdened management and service systems.

It is in these areas of maximum impact that new communities could serve to structure new growth that would complement the needs of the central city. In other areas where economic growth has slowed, economically self-sufficient new communities designed as growth centers might serve to attract new residents and reverse rural-to-urban migration. The contribution that such growth centers could make to the national economy by reviving lagging areas would be substantial. Moreover, new communities should be useful for testing innovative approaches to urban development.

In response to arguments such as these, the federal government has now guaranteed support to seven new community developments under the Urban Growth and New Community Development Act of 1970:

□ Jonathan, Minn., a new community 20 miles west of Minneapolis. It is to be largely self-sufficient in terms of employment, with low-, medium-, and high-income housing, village centers, and appropriate industrial areas. The U.S. Department of Housing and Urban Development has guaranteed up to \$8 million in obligations for land acquisition and development. Some facilities are already built, and the population may reach 50,000 by 1990.

□ St. Charles, Md., located 25 miles southeast of Washington. This community will emphasize low-income housing; 80 per cent of its 10,000 single-family housing units are to sell for less than \$25,000. Its target population is 75,000 by 1990.



Welfare Island, a proposed new-town-in-town in the East River opposite Manhattan, may be the most conspicuous new-community development in the U.S.

when completed. This east-facing plaza is to be linked by a colonnade to a similar west-facing one across the narrow island.

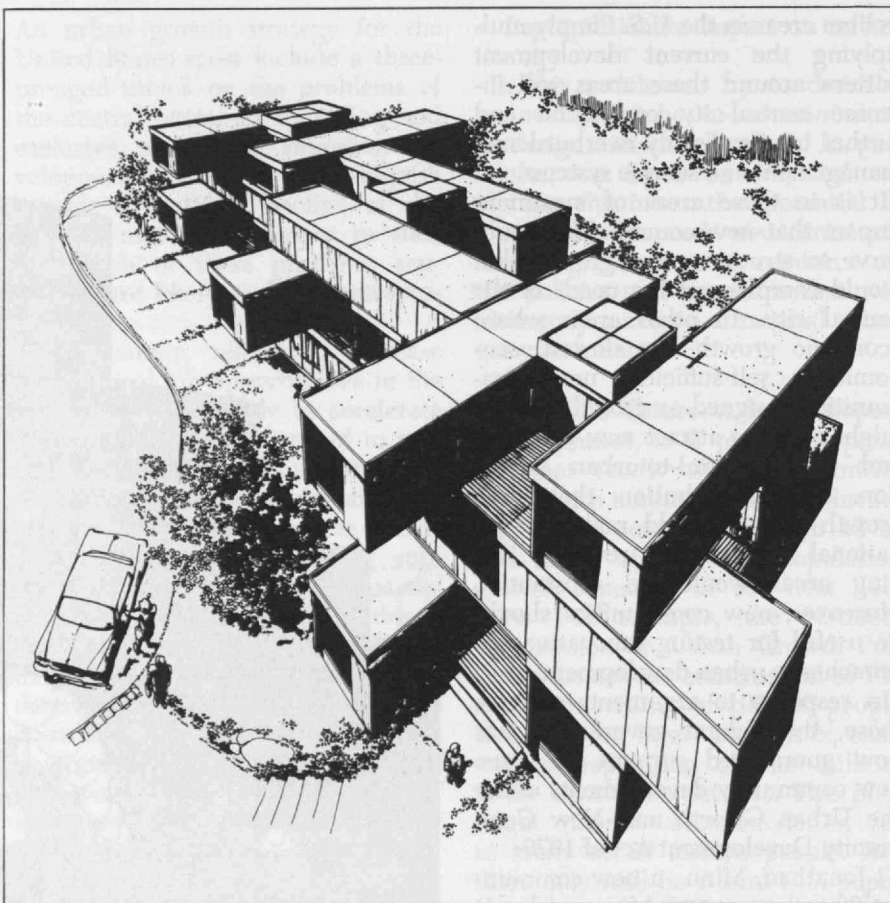
□ Park Forest South, Ill., centered around the development of a new "senior college" to be located in this suburb of Chicago. Its developers project a population of 110,000 by 1985.

□ Maumelle, Ark., located 12 miles from Little Rock along the Arkansas River development project. Recreation facilities and open spaces are to be prominent in this community, which is expected to grow to 60,000 population by 1991.

□ Flower Mound, Texas, to house 64,000 by 1990, located 20 miles northwest from Dallas, near the new Dallas-Fort Worth Regional Airport. The town will have 14 neighborhoods grouped into four villages clustered around a town center. Proposed technological innovations include an advanced solid-waste-disposal system, a property-protection-security system, an airport mass-transit loop, and internal "people-mover" systems.

□ Cedar Riverside, in Minneapolis, the first "new-town-in-town" to receive federal support. This is part of the 340-acre Cedar Riverside Urban Renewal Project one mile southeast of Minneapolis' central business district; plans call for an eventual population of 30,000 in 12,500 dwelling units to be constructed over the next 20 years, most of them subsidized through a combination of federal and municipal programs. Proposed innovations include an experimental education program, phasing of project construction to minimize the relocation of present residents and businesses, and "pairing" with the new community of Jonathan.

□ Riverton, N.Y., a 2,650-acre area of farm land near Rochester which will be developed for housing (population 25,600 by 1986), community programs, and industry (400 acres).



The first residents have moved into apartments and single-family homes in Jonathan, Minn.; three major industries have begun operations in new facilities; construction has begun on the first village center; and roads, utilities, open space, and other public resources are taking shape. Jonathan is expected to

grow to 50,000 by 1990; it is intended to be largely self-sufficient in terms of employment opportunities, and its developers are committed to providing subsidized low- and moderate-income housing (above) as well as more expensive homes.

The New York State Urban Development Corporation is requesting federal guarantee assistance for three publicly planned new towns in New York: Lysander, outside of Syracuse; Amhurst, near Buffalo; and Welfare Island, a new-town-in-town in New York City. Floyd McKissick, a civil rights leader, is seek-

ing federal support for the development of Soul City, a new community in North Carolina designed to spark industrial development in a region that has been short-changed by past patterns of urban growth.

New-community activity has been immensely spurred by the passage of the Urban Growth and New Com-

munity Development Act of 1970; it offers attractive incentives to public and private entrepreneurs and investors interested in the planned development of socially and economically sound new communities. The Housing Act of 1968 offered federal guarantees and supplemental grants to private developers for costs incurred in the development of new communities, and the 1970 Act extends these opportunities to public developers. It provides H.U.D. guarantees for the development of new towns-in-town (that is, the clearance and redevelopment of "functionally obsolete properties" in the central cities), planned suburban communities, and new towns in rural areas designed to spur development in lagging regions. Indeed, the government has already committed upwards of \$80 million to the development of the new communities listed above, and more than 50 privately developed new communities (which already have affected the character and scope of development throughout the country) are also under construction.

The National Conference of Mayors has called the current American preoccupation with new communities a form of "environmental escapism," and the mayors may be correct in the sense that privately developed new towns built in the last few years have offered little if any relief for those trapped in the inner city. Other new-community critics also argue that the development of publicly supported new communities will divert funds from inner-city redevelopment efforts. Still others doubt that the development of planned new communities can help to achieve a more balanced population distribution throughout the United States. The fact is that the contribution which publicly-funded (and publicly-developed) new communities might make to the resolution of inner city problems, to the rationalization of suburban development patterns, and to the economic and social development of depressed areas has yet to be demonstrated.

Several issues need to be raised in determining the role of new towns in a balanced national urban growth policy:

□ What kinds of experiments, demonstrations and innovations ought to be tried in new community projects? How can we learn from—and ensure

transferability of results from—successful new community experiments?

□ What public objectives can be accomplished through new community development? What is to be gained by governmental participation in the development process? Are there common objectives which all new communities ought to meet to merit governmental assistance?

□ What serious urban problems are likely to remain unaffected by new communities? What complementary components of a national urban growth policy may be required?

New Towns for Innovation

It is clear that new communities provide special opportunities for innovation. Most discussion centers about the possibility of testing new technological hardware: new waste-control systems, industrialized housing and other building systems, and new modes of transportation. But this potential for deploying sophisticated new technology is not the central issue. Important as such devices may seem, it is the process of managing community development which really requires special attention. New technology will undoubtedly be spawned by new community development, but it is the *process* of working back and forth between what is desirable and what can be accomplished that we must explore.

This is true for two reasons. First, it is not at all clear that the kinds of hardware now on the drawing boards will be appropriate to the kinds of institutions we might hope to build for the future. For example, a system for constructing school buildings from standard components may be excellent for educational institutions as we now know them, but existing systems may be entirely inappropriate to new teaching methods or future educational philosophies. New settings for education might well be places other than the traditional school or classroom, for example.

The second reason for emphasizing experiments dealing with the process of new community development is that communities must serve their residents well beyond the initial construction period. Initial technology may soon become outdated, and it is important to focus on ways of constantly adapting to changing needs and demands. Most "company

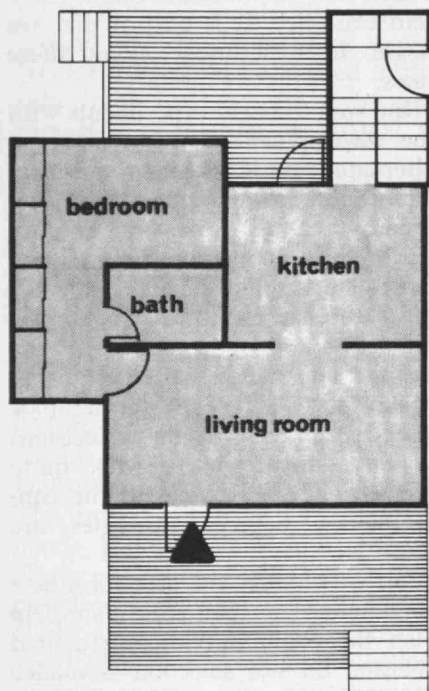
towns" built in the United States are examples of communities whose institutional structure could not make such adaptations.

For a variety of reasons, complex institutions develop an inertia which makes them progressively more resistant to changes in patterns of influence, roles, and concepts of purpose. The process of community development is likely to fix a course which will affect how residents feel about their community well into the future. We know almost nothing about deliberately shaping, in more than a physical sense, the ways in which new communities might come into existence. It is critical that we begin to experiment along these lines.

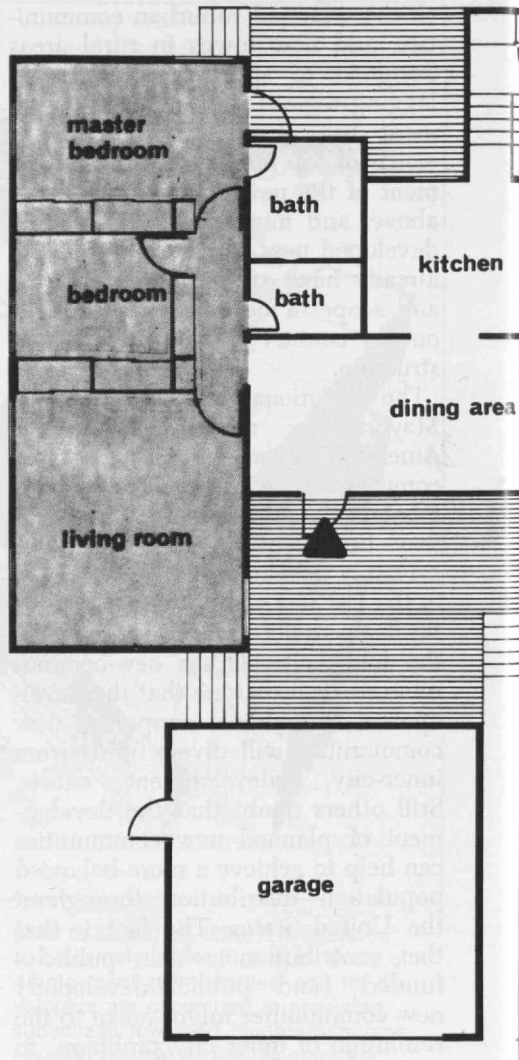
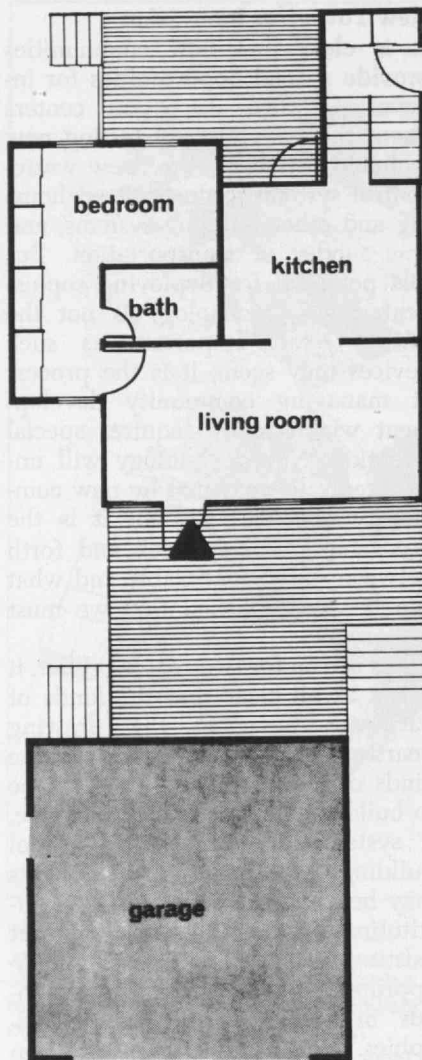
One way to begin experiments with the development process is to test alternate ways of planning and managing new communities. Two decisions that are usually made early in the planning phase have an almost irreversible impact upon the ultimate character of a community: the selection of a site and the amount and nature of the financing commitment. Experiments might be aimed at opening up these decisions to the ultimate users who, quite literally, have to live with the consequences. Several strategies are possible:

Can we identify the users of a new community so that they can help plan the community before a final decision on site selection is made? The New Communities Project at the Cambridge Institute is attempting to do this, and the planners of Soul City have considered ways of identifying potential residents so that they can be involved in the initial planning stages. If this is too difficult, can we identify and consult as advisers persons whose points of view are likely to be similar? (One word of warning here: involvement of surrogate users must go beyond the traditional market survey; they must have a part in generating the range of options as well as evaluating specific alternatives.)

Another useful strategy is to defer as many decisions as possible affecting the form of development until residents are on the scene. Indeed, the initial development might include temporary quarters for residents (short-term rentals) while they become directly involved in planning their own future environ-



Rational planning and new technology are obvious advantages for a new town. This house, designed in a panelized system for Jonathan, Minn., by George Nelson and Gordon Chadwick, can be expanded as family needs grow.



ments. Technologies and designs might be sought which break down what are presently large capital investments such as sewer and road systems into smaller components which may (or may not) be added incrementally, thereby avoiding long-term commitments to an overall physical form.

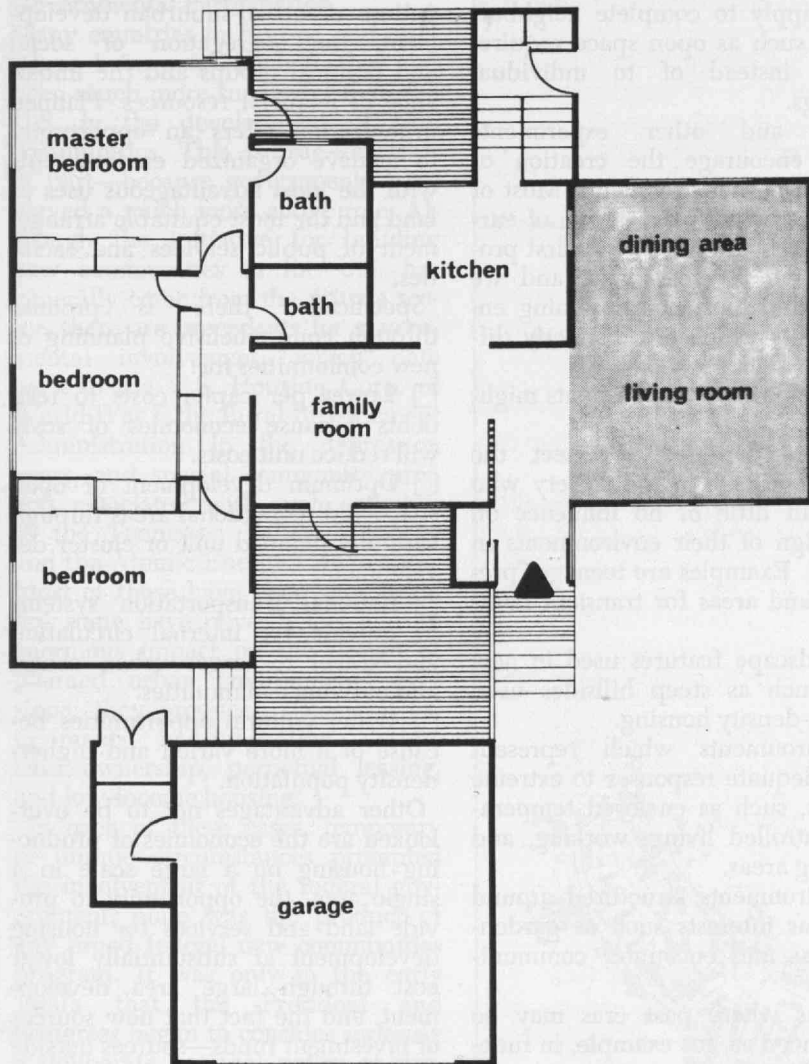
Still another possible approach

might be to build several smaller communities simultaneously so that each could offer very different combinations of site and cash flow characteristics. Communities which are deliberately planned to grow slowly (temporary users might be allowed to pay for the carrying costs of the land) might be paired with others which are planned to grow as

rapidly as possible. Funding commitments might vary accordingly.

These suggestions imply great flexibility in holding open the site and cash flow arrangements—flexibility which government backing can help to make possible. A policy of phased commitments may be necessary to control experimentation, but it should be possible to promise finan-

The potential for deploying sophisticated new technology is not the central issue; it is the process of managing community development which requires special attention and represents the special challenge of a new town



cial backing to innovative community development projects and strategies even in advance of actual site selection.

The process of actually constructing new communities is a second area for potentially fruitful experimentation. Communities might be supported in such a way that the process of construction provides job

training opportunities for the unemployed. Groups in Detroit, Mich., and Columbus, Ohio, are investigating the possibility of matching inner-city neighborhoods with new communities in the suburbs. Federal leverage might be used to promote job training as well as the establishment of new minority enterprises in relation to new community develop-

ment.

Low-income families may achieve more equity in their homes if partially-finished houses can be left to be completed by the residents in their spare time. Residents might also assume responsibility for certain public improvements including the landscaping of open spaces, maintenance of public areas, and construction of neighborhood facilities.

Institutional Innovation

The development of more permanent institutions in a new community provides another opportunity for innovation. Preventive health care on a community scale might become a major part of a plan for the delivery of health services; prepaid group practice arrangements might be tested. Free legal assistance for all residents might be possible using specialized information and communications systems.

One can easily foresee political conflicts which jeopardize such innovative, flexible plans. The first residents will seek to establish the future pattern of services and development. Later residents may have different ideas. The developer or builder who must meet a rigid construction timetable will try to eliminate uncertainties and may be unable or unwilling to depart from plans or change commitments in ways which might reduce his return on investment. Renegotiation of government assistance and other funding commitments after residents have begun to assume control of the community may be necessary to assure flexibility and responsiveness—and somehow should be part of the plan. Experiments with various ownership formats—condominiums, cooperatives, etc.—and other mechanisms for local control will be valu-

able; several institutional innovations such as the following ought to be tried:

☐ Small quasi-governmental units. Can control over the services traditionally provided by city-wide governments be dispersed to small groups of residents or to neighborhood associations? What are the costs of disaggregation?

☐ Special service districts or corporations. Can local development corporations be designed to control the delivery of services? Can debt repayment be transferred from the developer to the community or service districts in increments?

☐ Annexations, independence, or consolidation. Under what conditions does annexation by an existing city, creation of a new municipality, or consolidation with a larger entity such as a county make sense as the ultimate form of government for a new community?

☐ Community management. Can we find better ways of raising issues of community concern, disseminating information, and resolving community conflict through neighborhood forums, ombudsmen, or new forms of media, particularly cable television?

Innovations in Style and Form

Zoning and development standards are a source of continuing frustration in existing cities, because residents cannot foresee the likely consequences of one or another kind of development standard and because new development requirements have to be written in terms that allow existing structures to comply. New communities will offer an unparalleled opportunity to test new forms of regulation (such as transferrable development rights and "floating development zones") and standards

which apply to complete neighborhoods (such as open space requirements) instead of to individual buildings.

These and other experiments should encourage the creation of unique urban environments. Most of the prototypes for the design of current new communities were first proposed over 50 years ago, and we have little experience designing environments which are distinctly different.

New community experiments might involve:

☐ Places designed to meet the needs of groups in the society who have had little or no influence on the design of their environments in the past. Examples are teenage "precincts" and areas for transient families.

☐ Landscape features used in new ways, such as steep hillsides used for high-density housing.

☐ Environments which represent more adequate responses to extreme climates, such as enclosed temperature-controlled living, working, and shopping areas.

☐ Environments structured around particular interests such as gardening areas and encounter communities.

☐ Areas where past eras may be experienced as, for example, in functioning historic villages.

Public Objectives

If social rather than technological innovation is the particular virtue to be sought in a new community, how can this purpose be achieved, and what place do the new communities have in our overall efforts to improve the quality of urban life?

One argument in favor of planned new communities is that they can help us to break out of the existing

pattern of urban-suburban development, the segregation of social and political groups and the imbalance of financial resources. Planned urbanization offers an opportunity to achieve organized environments with the most advantageous uses of land and the most equitable arrangement of public services and facilities.

Specifically, there is promise through comprehensive planning of new communities for:

☐ Lower per capita costs to residents because economies of scale will reduce unit costs.

☐ Optimum development of open space and recreational areas through carefully planned unit or cluster development.

☐ Rational transportation systems to provide for internal circulation and travel to larger urban center and outlying communities.

☐ Wider cultural opportunities because of a more varied and higher-density population.

Other advantages not to be overlooked are the economies of producing housing on a large scale in a single area, the opportunity to provide land and services for housing development at substantially lower cost through large area development, and the fact that new sources of investment funds—sources outside the traditional capital market—can be tapped.

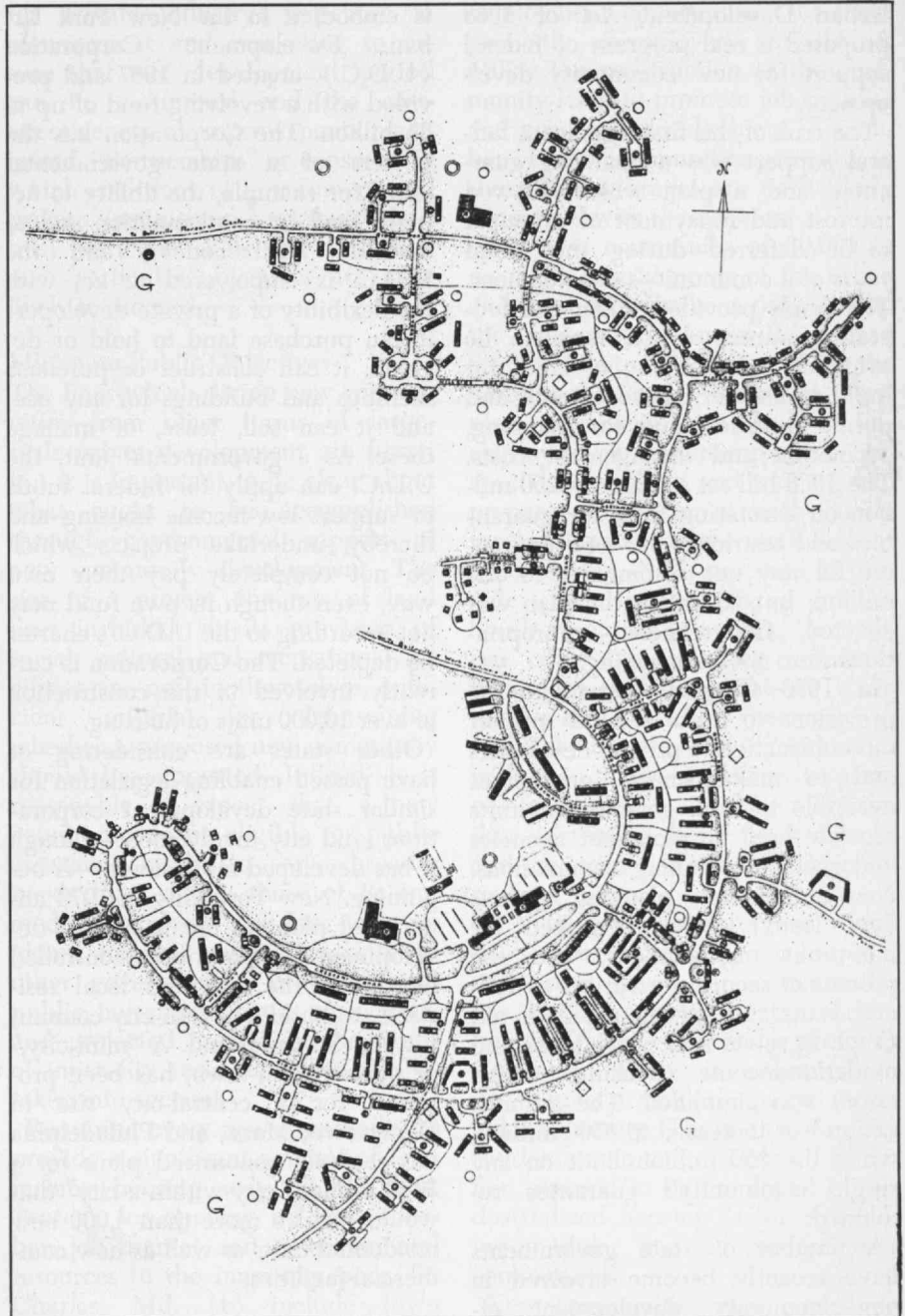
In addition to the advantages listed above, new communities—if government-controlled and to some extent subsidized—hold prospects for increasing the housing supply for low- and moderate-income people; maximizing employment opportunities outside of central cities for low- and moderate-income workers; and stimulating the economic and social development of lagging regions.

The private development market as currently structured is not capable of accomplishing the broad range of social goals that can be assured through increased public involvement. But the private developer is an essential partner

Governmental Participation

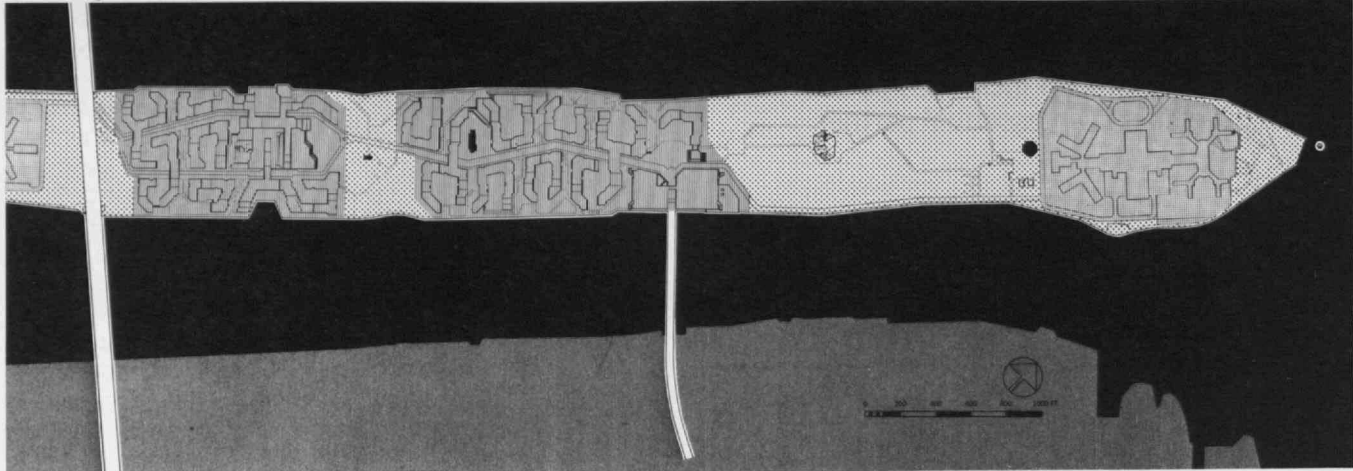
Many countries in Europe and elsewhere have gone much further and been much more successful than the U.S. in the development of new communities. This is true—at least in part—because governments have played a much more active role. Although the initiative for building new communities in the U.S. has generally come from the private sector, there are precedents for governmental involvement, which date back to the U.S. Housing Corp. of World War I, the Rural Resettlement Administration in the depression years, and special community projects associated with such activities as the Tennessee Valley Authority and the Atomic Energy Commission. Most of these have been short-lived but some have nevertheless had an enormous impact on the design of planned urban environments ever since; they produced successful experiments in innovative design, land ownership, perpetual leasing, and low-income housing.

In each of these cases, temporary or unique circumstances prompted the involvement of the federal government; none was the product of any broad federal new communities program. It was only in the early 1960's that the President and Congress began to consider seriously a deliberate national policy of support for new community development, and it was only in 1966, when privately-financed new communities were beginning to generate publicity on the basis of their successes and failures (as an example of the latter, the financial problems of undercapitalization during the early development of Reston, Virginia), that the Congress passed the first new-communities legislation. Two years later, amendments in the Housing and



Greenbelt, Md., was built as a new community during the depression by the Rural Resettlement Administration. It offered no industrial employment oppor-

tunities but included such features as playgrounds (O) and allotment gardens (G).



Urban Development Act of 1968 proposed a real program of federal support for new community development.

The crux of this first significant federal support was a financing guarantee and a plan which allowed interest and repayment of principal to be deferred during the initial years of a community's development. The funds provided under the federal guarantee which were to be available for purchase of land; for building utilities, improvements, and public facilities; and for planning, promotion and management costs. The 1968 bill set a limit of \$250 million on a rotating fund for guarantees and restricted the total guarantee for any one community to \$50 million; but, although the plan was enacted, Congressional appropriations were not forthcoming.

In 1970 Congress extended the provisions to make federal support more attractive to private developers and to make similar guarantees available to such government units as state land development agencies and regional planning commissions. New-community planning grants (not loans) were authorized for non-profit organizations, and the process of securing a variety of federal loans and specific grants-in-aid (such as sewer and water loans and moderate-income housing assistance) was simplified. The authorization was increased to \$500 million, while the \$50 million limit on any single community's guarantee remained.

A number of state governments have recently become involved in new-community development efforts, and New York State now has one of the most significant urban development programs ever attempted in the United States. This

is embodied in the New York Urban Development Corporation (U.D.C.), created in 1967 and provided with a revolving fund of up to \$5 billion. The Corporation has the powers of a state governmental unit (for example, the ability to acquire land by condemnation and to override local codes), and the U.D.C. is empowered to act with the flexibility of a private developer: it can purchase land to hold or develop; it can construct or purchase facilities and buildings for any use; and it can sell, lease, or manage these. As a governmental unit, the U.D.C. can apply for federal funds to support low-income housing and thereby undertake projects which do not completely pay their own way, even though its own fund may not according to the U.D.C.'s charter be depleted. The Corporation is currently involved in the construction of over 10,000 units of housing.

Other states are considering or have passed enabling legislation for similar state development corporations, and city involvement—though it has developed more slowly—is beginning. New York City in 1970 announced plans to create a local development corporation, controlled jointly by the city and local residents, to build a new in-city community on Staten Island. A "mini-city," or new-town-in-town, has been proposed for a central-city site in Watertown, Mass., and Philadelphia has recently announced plans for a \$400 million "city-within-a-city" that would involve more than 4,000 new residential units as well as new commercial facilities.

Private New-Town Development

This increased commitment on the part of governments is justified by the considerable difficulties faced by

private developers. The risks involved in building a new community are tremendous, and to date private developers' records in achieving public objectives have not been very good. The enormity of the undertaking, the lack of eminent domain power, the total absence of early financial returns on a large initial investment, and the inevitable uncertainty of doing something new are only a few of the difficulties that the private developer must face. Because of high risk and low early return, large investors have been reluctant to back private efforts to build new communities.

Yet the fact remains there are as yet no recent examples of publicly-developed new communities, and privately-developed new communities have been able to achieve some critical social goals (providing low-income housing, increasing the job base of the region, providing educational and cultural facilities, maximizing open space) in so far as these goals have coincided with the private developer's objective of making an acceptable profit.

The private developer is under a constraint to provide primarily what will be marketable and profitable. He has traditionally begun his involvement with the purchase (or prior ownership) of a large parcel of land and then has planned his new community within the constraints of the market, his financial capabilities, and local government regulations on land use. Three critical problems are inherent in this traditional land-first approach:

□ Because the developer fails to clarify the goals of new community development through careful planning before he purchases the land, he is frequently forced to make compromises to meet the political, finan-

The Welfare Island plan for a new-town-in-town in New York's East River incorporates a few existing hospital structures and adds to them "bands" of different activities: five bands of parks and greens alternate with four bands of building groups. The four-mile waterfront is to be a continuous promenade.

cial, and social constraints imposed on the use of his site.

□ The final purchase price for the land and the market at the time of development are likely to be the most critical factor in determining what uses and densities are possible, regardless of what the developer or the eventual residents might think most appropriate.

□ The plan often fails to reflect the needs and growth potential of the region in which the new community is being built. The builder is generally not concerned with the impact of his development on the entire region's growth—the employment and cultural activities it will attract away from areas of greater need within the region and the discontinuities in regional and state services that will be created.

Indeed, the major criticism of new communities built thus far in the United States rests on the argument that they have not been conceived as part of an overall national urban growth strategy.

This experience should not lead to the conclusion that new communities are incapable of achieving social goals. On the contrary, it merely suggests that the private sector as currently structured is not capable of accomplishing the broad range of social goals that could be achieved through increased public involvement. Government involvement is needed not to substitute for private action but to attract it and to direct it in ways that benefit both new communities and their surrounding environments. The private developer, though, is an essential partner without whom new communities probably could not be built at all.

How can governments and private investors work together to achieve

the best result? The key factors in the success of any new community development are: sufficient capital; a relatively short development period; a location which is developable, accessible, and available; ownership of the land prior to starting; as few legal restrictions as possible; and a competent administrative and marketing team.

The purchase of land may best be handled by a public body which has the power of eminent domain. A public corporation such as U.D.C. can more easily cut through the maze of local development restrictions. But there is no substitute for private industry's expertise in management and marketing to assure that the development period can be minimized and the cost-effectiveness of improvements maximized. "Partnerships" or consortia in which coalitions of government and private institutions contribute their own particular skills and seek their own particular objectives are most likely to succeed.

Minimum Public Objectives

The lines which divide new communities from other forms of large-scale urban development are fuzzy, but it is important to be clear about what ought to be accomplished through governmental support of new community development. The size of a project, the mix of land uses included, or its provision of social, cultural and recreational facilities are not, in themselves, sufficient criteria for determining whether a proposed new community should be supported. Indeed, it is reasonable to expect that a new community to be eligible for public assistance ought to serve broader needs than simply those of its immediate residents. The long-term regional impact, complementarity to other governmental programs and public investments in a given area, and projected impact on the needs of inner-city residents must also be taken into account.

Requiring every new community to provide a significant amount of low-income housing may be the best strategy for opening up the suburban job market and environmental resources to the inner-city poor. St. Charles, Md. (to include town houses, garden apartments, and mid-rise apartments) is an example of a community where exceptional housing opportunities are to be provided

for low- and moderate-income families. Almost 10,000 single-family houses are to be built, and almost 80 per cent of them are to sell for \$25,000 or less. In addition, at least 25 per cent of the rental units are to cost less than \$150 a month.

Contribution to employment opportunities for low- and middle-income families is a second consideration in evaluating the potential of a new community. What is important is not that a new community simply provide jobs but rather that it help to balance a region's economy by making it less subject to cyclical fluctuation, that it promise training and employment opportunities for those presently unemployed, and that it utilize the construction of the community itself to promote job training and economic development. A number of new communities presently in the planning stages are particularly concerned with these issues:

□ A new community of 80,000 to meet the special needs of the urban and rural poor has been proposed by the University of Louisville's Urban Studies Center. Almost half of the families that arrive during the first phase of development would be unemployed or under-employed, and special counselling and training will prepare a member of each family for participation in the work force.

□ Soul City, N.C., proposes to provide poor families living in the South an option to moving to northern cities by attracting industries willing to provide on-the-job training for virtually all of their employees. They are also seeking industries willing to allow employees to participate financially in the enterprise, thus increasing both the residents' and the industries' stakes in the community.

□ A development program which pairs poor inner-city communities with new perimeter communities has been proposed for the metropolitan Detroit area, and a group in Columbus, Ohio, is interested in developing a similarly paired new/old community. The plan is for city residents soon to be displaced by urban renewal to be employed by industrialized housing factories building modular housing for the new communities.

New communities may contribute to sound regional development by making unique environmental resources available to residents of a metropolitan area. Waterfront areas

in many American cities are sadly neglected, and they are possible sites for new in-city communities which could be planned to make a variety of water-oriented facilities available to the city as a whole. The Welfare Island development will serve this purpose in New York City, and several suggestions for development of Boston's harbor islands have these ends in view.

Government new-town participation may take the form of capitalizing upon opportunities created by other government projects or programs. For example, excess federal lands might provide ideal sites for new communities. Government participation will be necessary to realize these potentials; Maumelle, Ark., one of the six projects approved under the H.U.D. New Communities Program, was formerly the site of a federal ordnance facility. A new community has been proposed for Fort Lincoln in Washington, D.C., and abandoned facilities in Hingham, Mass., and at Otis Air Force Base on Cape Cod have also been suggested as possible sites. The fact that land costs are minimal almost guarantees that housing costs can be reduced. But it is wrong to assume that these sites must be used simply because they are available.

Various governmental actions may create situations such that new communities should be considered: when a major new highway is built through a wilderness area, new demands and opportunities for development are created in that area; or where improvements as part of river basin development encourage both industrial and recreational uses; or where major government investments (for example, public works projects, airports, universities, or laboratories)

Economic and aesthetic issues combine to suggest that most new towns plan for phased growth. These land-use maps show such a plan for Shelby Farms, proposed for a 5,000-acre site 12 miles

east of Memphis; an ultimate 65,000 population is accommodated in four phases, with about 4,500 dwelling units involved in each phase.

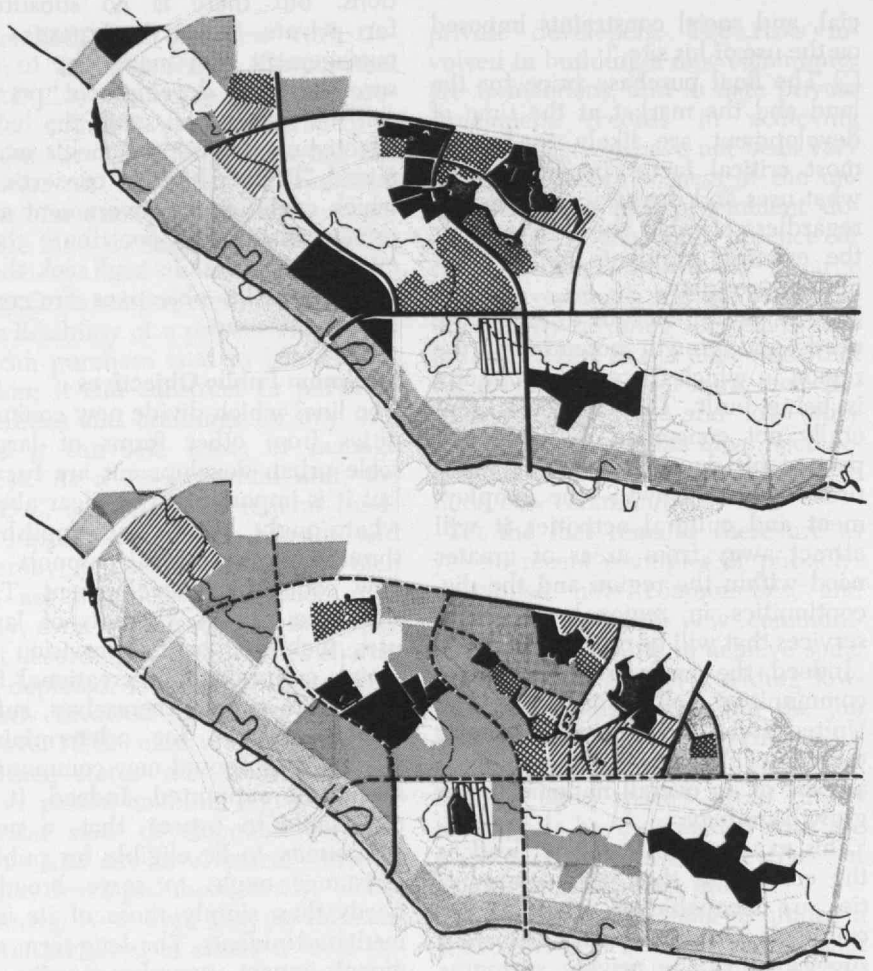
result in an increased demand for new manufacturing and housing facilities.

Criteria for Different Conditions

All new communities ought to meet certain public objectives to be eligible for government assistance: they should provide new housing and employment possibilities for

low- and moderate-income families, protect unique ecological resources, and obtain the greatest secondary benefits for an entire region.

But beyond these fundamental standards, somewhat different criteria should be used to measure the desirability of new in-city communities, new towns on the metropolitan periphery, and new communities



Are the financial risks associated with achieving the proper public objectives in new towns so severe as to make extensive private investment unlikely? Yes, almost surely—unless federal guarantees are effective enough to loosen purse-strings



which are designed to promote social and economic development in lagging regions. Under the present administrative guidelines, however, H.U.D. does not differentiate among proposed new communities in evaluating feasibility and long-term benefits. For instance, Soul City is a new community designed to spur economic and social development in an

"underdeveloped" portion of North Carolina. Since unemployment in the area is high, the developer should not be expected at the outset to provide for middle-income housing or to show an existing demand for extensive commercial facilities. But if Soul City is going to be economically feasible, the developer will need federal support, and the

federal government (if it decides to support the proposed project and wishes to maximize its impact on the region) will have to take a greater risk than it would in supporting new communities in suburban areas. Flower Mound, Texas, is a very different situation; in the growth "corridor" between Dallas and Fort Worth, the risks are far lower. The potential long-term benefits of Soul City, a new growth center in a lagging area, probably justify a greater investment even given the greater long-term risk.

A new in-city community presents different kinds of problems and ultimately different kinds of risks at different costs. Still other issues are unique to communities proposed for the metropolitan fringe. Site selection should be conditioned by the availability of transportation to the inner city, and every suburban new community development ought to provide inner-city residents with first choice in the selection of new housing and job opportunities.

Governmental participation in new community development ought also to guarantee support for genuine innovation. Indeed, the Advisory Commission on Intergovernmental Relations concluded recently that experimentation ought to be a principal justification for direct federal involvement in new-community development; a modest program of experimental community development on federally-owned lands was recommended. Our view is that innovations should be sought in all new communities, and federal programs should be flexible enough to fund them.

Some critics argue that the financial risks involved in building new communities are too great to encompass the additional risk-taking which

most innovations and experiments imply. Private developers, especially, hold this view since they must ensure the marketability of their developments in every way they can. But federal guarantees now available will help to loosen some of the financial constraints on risk-taking; indeed, one way to insure a maximum impact of the modest federal revolving fund would be to use it in support of the most exciting experimental projects.

How Can We Learn from New Community Experiments?

How shall the success or failure of experiments or innovative approaches be judged? Donald Schon has pointed out (*see his article "On Bringing Technology to Social Problems" in Technology Review for February, 1971, pp. 46-51*) that experiments in community development or institutional innovation are different from experiments in the physical sciences in at least three ways: the large number of variables involved in any situation make it virtually impossible to undertake classical matched-pair experiments; "scaling up" may change the nature of the problem and invalidate the results of a pilot experiment; and, since humans are involved, success and failure are always relative and subjective concepts.

When an unmanned satellite misses its mark it continues into outer space; we easily forget about the rocket and focus on what can be learned to improve the next try. Although the costs of developing a new community are about the same as those of sending a satellite to Mars (roughly \$45 million), we are unlikely to abandon a new community if it fails to meet expectations. Short-comings will have to be corrected; the individuals involved in new community experiments—planners, administrators, investors, and residents—must also learn to improve the process for the future.

A rigorous monitoring system is the first requisite for learning from experiments. Monitoring should indicate the performance of the community at the local level, where feedback will allow for frequent adjustments, and at the national level, where alternative new-community development strategies can be evaluated. Since communities take years to develop, long-term recording of events, perceptions, and

changes will be required.

The process of research should begin with each initial participant in the development process recording his or her expectations; designers ought to spell out the various opportunities that they envision for each new community, and investors ought to be specific about profit expectations. Monitoring should include the periodic collection of photographic, visual, and verbal records of the community, and an archivist should be designated to collect and hold impressions and records in every new community.

There should be annual national surveys of all new communities to provide consistent comparative information, and this information should be available from a central clearing house. Federal or state funding for new communities should include the costs of both in-house and outside monitoring and appraisal, including efforts extending well beyond the life of the actual experiments.

Finally, since one important objective of experimentation is to increase our ability to adapt and to modify existing city environments and institutions, the development of new communities should be used to provide training opportunities for a new generation of environmental planners and designers. This is an obvious and appropriate role for universities now engaged in environmental education and the training of urban planners, and the federal government might well assure the formation of consortiums of professional and academic organizations for this purpose by including in new-community grants modest, long-range funding for monitoring and evaluation.

New Towns in Urban Development

The social, physical, and economic conditions of existing cities and towns must be improved; but if we are to break the continuing pattern of urban decay we must provide attractive options to big-city living for all groups in the society. The first National Urban Growth Report (mandated by the Congress in 1970) is scheduled to be released this month. We hope that the report will acknowledge the need for clearly defined urban growth objectives. For example, we need "changed money flows" designed to provide struggling municipalities

with the funds for social and economic development programs; possibilities include some form of federal "revenue-sharing," and changes in revenue-raising methods; the latter might result in less reliance on the property tax and greater emphasis on income and sales taxes at the state and city levels, federal income tax revisions that would close existing loopholes, or some form of a "value-added" tax. The federal government may also have to take additional steps to guarantee the flow of mortgage money or to implement housing allowances for the poor if we are to meet basic housing production goals.

Additionally, the urban growth report ought to be concerned with the redistribution of control over various aspects of urban development. We hope that the general trend will be toward a more rational linkage of intergovernmental planning and development responsibilities.

Publicly financed new communities are but one component of an overall growth strategy. New communities do provide a unique opportunity to test new mechanisms and even to protect unique environments. The task of developing totally new communities may also provide us with the opportunity to invent real alternatives to existing patterns of urban living. But, a new communities program is not an acceptable substitute for more comprehensive national urban growth strategy.

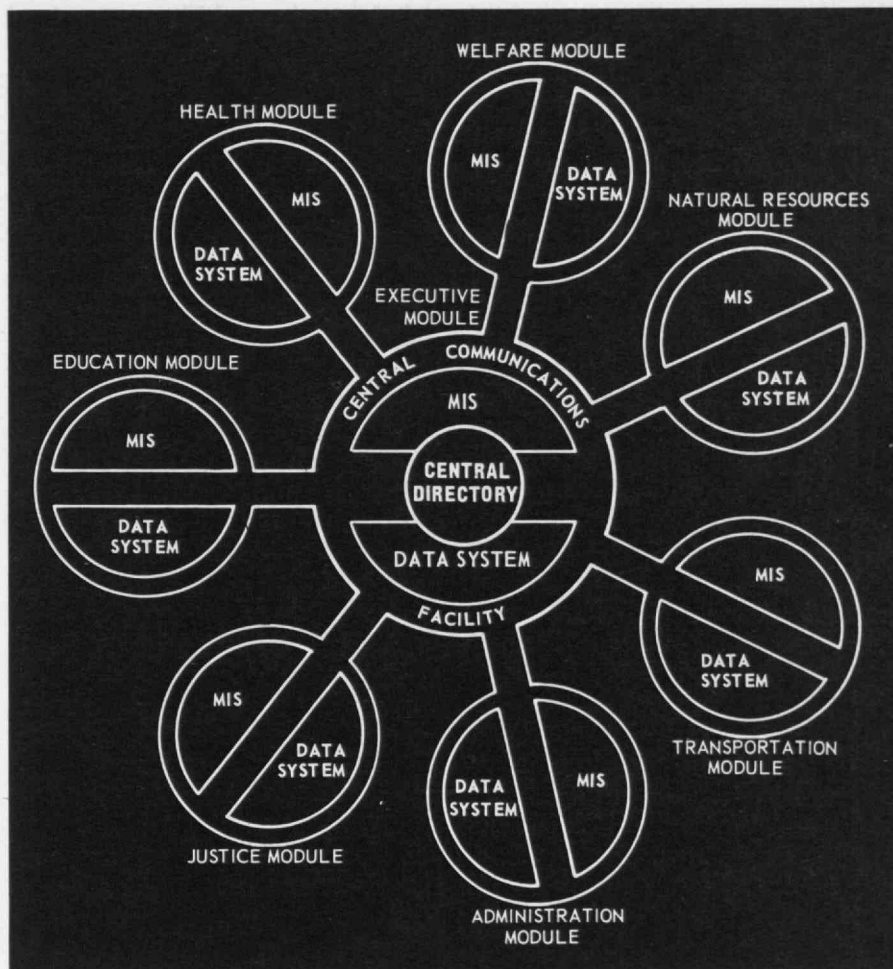
Computers in State Government

Automated information systems alone cannot solve the problems facing state government, but the proper use of such systems can help to make government more responsive and efficient

State governments are massive information processors. Forms, records, and reports are constantly being filled out, processed, filed, retrieved, updated, refiled and eventually stored. As state agencies have come to provide more and more services, effective record-keeping by manual clerical procedures has become exceedingly difficult—often impossible. As a result, computers are today being applied in all functional areas of state government. The National Association of State Information Systems estimates that nearly 600 computers are currently installed in state government agencies (excluding higher education).

What are the consequences of this trend? One thinks immediately of financial savings, of improvements in efficiency and speed. In so far as computers have been wisely acquired and used, such benefits are indeed visible, although, as I shall show, most of the possible material improvements remain to be achieved. There are also consequences of other kinds, including political ones.

Start with the economics: state-government automated information processing is a \$250-million-a-year industry. However, each individual state's contribution to this total is relatively small, usually representing less than one per cent of the total state budget. From their computer investments, state governments have reaped huge cumulative economic dividends, not to mention greater accuracy, reliability, and responsiveness. Pennsylvania's Bureau of Management Information Systems conservatively estimates that the installation of automated information systems has enabled the state to avoid the cost of 22,000 additional em-



Alabama's proposed management information system (M.I.S.) is an example of the kind of centrally organized state computing operation that the author

recommends. At present it is more usual for state agencies to operate independently, resulting in much wasted effort and expenditure.

ployees—an annual saving of approximately \$145 million.

Nevertheless, the costs associated with automated data processing (A.D.P.) in state government have risen at a rate which some consider alarming. The number of computers involved has nearly doubled in the past four years—and fees paid to consultants, in that same period, ap-

pear to have increased by a factor of ten.

Studies in some states have revealed a shocking proliferation of computer equipment among the disconnected government agencies, and numerous instances of duplicated development efforts. Moreover, equipment has frequently been under-utilized (which is

wasteful), there has been a lack of documentation (so that only a few people know the details of a particular system) and a general lack of standardization in the procedures for acquiring and operating computers, so that quite needless mistakes are common. Agency heads have often failed to realize that the unique characteristics of specific equipment are less important than good systems design and have naively competed with each other for bigger and shinier machines.

Recently, waking up to this situation, most states have indeed begun to establish central control over the acquisition and operation of their computers. A strong, technically competent central authority to oversee state-government automatic data-processing (A.D.P.) operations can make a dramatic difference.

For example, California's State Office of Management Services claims to have: halted the proliferation of unnecessary computers; controlled A.D.P. expenditures; established specific policies on the acquisition and use of computers; increased the sharing of computers (and created a general-purpose shared computer utility); adopted a long range (five-year) A.D.P. plan; and provided A.D.P. training to state employees.

In the following examples of current and potential computer applications in state government, I shall try to show how computers can serve state governments as invaluable tools for decision-making. However, since governmental decision-making is fundamentally a political process, there are and will always be things that computers cannot and—more importantly—should not do.

Administration and Finance

The past few years have brought a continuing sharp rise in the cost of state government: with multi-billion dollar state budgets already a reality, automated appropriations-accounting and budgetary control systems are needed to provide the information necessary for the intelligent allocation of available funds; they can also help an individual agency head discover whether allocated funds are in fact being efficiently used.

Ohio, for instance, has a fiscal-management reporting system which automatically checks the accuracy and validity of each billing before it is accepted. Further, by providing daily reports giving the status of all accounts, the system helps to pinpoint potential fiscal problems before they become critical. It also provides monthly and annual reports on the first day following closing, and enables payments to vendors to be made no later than the date on which they are due. A not-inconsiderable side benefit of computerization has been the development of improved cash control and investment procedures, which have resulted in a three-fold increase in interest income.

Compare this to a state where the governor discovered—too late—that even as he was proposing an all-out fight against water pollution, his Department of Finance had been cutting the telephone expenses portion of his Water Pollution Control Division's budget proposal. As it turned out, this single budget cut of only a few thousand dollars crippled the pollution-reporting program.

With budgetary information obscured—as it often is—both agency budget requests and finance depart-

Water characteristics:

- Hydrogen ion concentration (pH)
- Specific conductance
- Dissolved chlorides concentration
- Dissolved oxygen concentration
- Temperature
- Turbidity
- Solar radiation intensity
- Air temperature
- Dissolved fluorides concentration
- Flood stage height

Air characteristics:

- Sulphur dioxide content
- Nitrogen oxide content
- Aldehydes
- Oxidants
- Carbon monoxide content
- Total hydrocarbon
- Wind direction
- Wind speed
- Wind sigma (horizontal)
- Wind sigma (vertical)
- Solar radiation
- Total radiation
- Atmospheric pressure
- Particulate matter
- Precipitation
- Temperature
- Relative humidity

New York State is installing a pollution-control system with automatic air- and water-quality monitoring stations. A central computer will check the air stations every 15 minutes and the water stations every hour, and generate a warning if conditions are unacceptable. The table lists the characteristics monitored. ("Sigma" is a measure of turbulence or gustiness.)

ment recommendations are capricious at best and too often totally unrealistic.

Some states still retain systems of central controls so inhibiting that agency heads require Finance Department approval every time they

Since governmental decision-making is fundamentally a political process, there are and will always be things that computers cannot and—more importantly—should not do

need even to move a telephone, for example. Such controls are designed to prevent misuse of funds—but they do not help to prevent, or even to spot, other forms of mismanagement, and they tend actually to obstruct the intelligent allocation of resources. Automated program budgeting offers the possibility of relaxing ineffective central controls and replacing them with competent, decentralized operations.

Abraham Lincoln once wrote, "If we could first know where we are and whither we are tending, we could better judge what to do and how to do it." A computer-assisted management information system would have helped him; it can, in a timely and accurate manner, provide reports of expenditures, compare actual expenditures with budget estimates, and note unusual variations in cost. Such a system can not only lead the governor out of the dark; it could take the blinders off the legislature as well. Given the facility of on-line inquiry, legislators would be better able to judge the wisdom of each requested budgetary allocation.

Resources and Development

Departments of Commerce serve as clearinghouses for economic information. On the basis of data published by local, state, and federal agencies, they produce area profiles and statistical abstracts and attempt to do economic planning. A very large number of factors must be considered in the formulation of economic plans; preparing good regional or statewide plans is exceedingly difficult if not impossible without the assistance of a computer. Wisconsin and Alabama are among the states which will soon have operational computer systems

for this purpose.

Kentucky is formulating a computerized information system to aid in preparing comprehensive outdoor recreation plans. The system will operate within the framework of an over-all statewide resource control plan, and it should greatly improve feasibility and impact studies of proposed recreation facilities. Kentucky is also developing an information system to assist in water resource planning by generating supply-and-demand projections for municipal and industrial needs, recreation, power, navigation, and irrigation.

State governments have generally failed to utilize computers effectively in planning and development, but this failure is minor compared with the states' almost total abdication of responsibility in the development of information systems for local governments. Perhaps the best measure of this failure would be the amount of available federal aid which goes unutilized because local governments are unable to gather and process the information necessary to qualify for the help they need. The federal government has helped some cities in such work, and others have managed to automate certain municipal functions on their own or in cooperative ventures. In Louisiana, for example, an automated federal-aid control system helps to coordinate applications for federal aid by political subdivisions (or state agencies), and to monitor all federal grants.

Even where they exist, the services which state governments provide to local governmental units are in some instances nothing to brag about. In one state the Teachers' Retirement Board is 22 months behind in the recording of information needed to calculate estimated an-

nuitant status. Veterans' Service Office disbursements to cities and towns are over \$500,000 in arrears, and as a result some municipalities have had to assume short-term debt in order to meet their obligations. As much as one to two years will elapse between the time a local government seeks to fill a vacant position and the time a state Civil Service Commission prepares a list of eligible candidates for the post.

Throughout the past decade there has been talk of using state data-processing centers to provide services to local governmental units. But even today there are few examples, despite an even greater need for intergovernmental coordination and the cooperative development of data-processing applications. California (through its Intergovernmental Board on Electronic Data Processing) and Pennsylvania (through its Interagency Municipal Information Systems Advisory Committee) have been in the forefront of developing such activities.

As an example of one service that could be provided, consider solid-waste disposal. The creation of centralized disposal facilities and the reduction in available landfill sites imply that solid waste collection, hitherto purely a local matter, will soon have to be considered on a statewide basis. State governments in such circumstances could plan schedules and routes to reduce transport costs—usually the dominant factor in waste disposal—by offering vehicle-scheduling systems to assist and coordinate local waste collection and disposal operations.

Consumer Affairs

While it may be politically expedient for a Commissioner of Insurance to deny a request for higher automo-

Q.1:ANYONE/JOHN/J/.
2:W M.
7:7/10/41.

A LEIN 4234 61 02/13/69 1316 ELCN/001.
RE:ANYONE
SYSIDNO:00136938,PTS:200,WHITE/MALE,07/10/41,602,185,
BROWN,BROWN,A123-456-789-123,123-45-6789,

FELONY WARRANT FOR MURDER & NONNEGLIGENT MANSLAUGHTER.
ANYONE/JOHN/J/,316 ANYNAME ST,NEW HUDSON,MI.
ELCN/001,ABC1234,02/06/69,69/LA1068,EXTRADITE,WILL PICKUP ENTIRE STATE
NCIC 02/13/69
TEXT:FOR TEST PURPOSES ONLY
IMMED CONFIRM WITH ENT JURIS.

Michigan's Law Enforcement Information Network (L.E.I.N.) answers a typical inquiry about a suspect; his name, race and sex, and date of birth are given (above), and the inquirer receives in response the type of data shown in the lower sample transmission.

medical services. A computer-printed statement is issued within ten days of treatment, verified (as to type of treatment and cost) by the provider of the treatment, and forwarded to the Florida Department of Health and Rehabilitative Services, which pays the bill within 30 days. The system can provide up-to-the-minute daily, monthly, and annual reports on the utilization of Medicaid, categorized by type of service. The ready availability of such information can be most helpful in preventing budgetary crises.

Under the direction of the U.S. Department of Labor, statewide job-bank programs are being established throughout the country. Missouri's Division of Employment Security provides computer-generated listings of job openings, on microfilm, to its local offices in the St. Louis metropolitan area. Utah has a computerized job-matching system which can handle up to 36 selection criteria. The Utah computer system also monitors the quality of its own service to job applicants—it prints out and sends to the local office a full copy of the application of any individual in the active file who has received no service during the preceeding 15 days, or has been selected five times by the computer but never referred to a potential employer, or referred three times but never hired. The system also reminds local office personnel of any selections, call-ins, or referrals that have been pending for three days. Should an applicant who is receiving unemployment insurance or welfare benefits refuse to accept a suitable job, the system immediately notifies the local unemployment insurance claims office or the department of public welfare.

Workmen's compensation boards

were among the first state agencies to install punched-card equipment. However, some industrial accident boards still have not discovered that computers can help to reduce compensation backlogs. In one state the Industrial Accident Board is so far behind that workers awaiting settlements are forced on to welfare rolls, at an estimated cost of \$1.5 million annually in excess welfare costs alone.

Public Safety

Thanks to the infusion of federal aid, a number of statewide police telecommunications systems have been implemented. A policeman can radio the license number of a vehicle under surveillance to his dispatcher and in a matter of seconds know whether the vehicle has been reported stolen or used as a getaway car in a serious crime. In addition to F.B.I. and police data on vehicles, these systems contain information on stolen parts and equipment, boats, firearms, license plates, stocks, bonds or other securities, and wanted or missing persons.

In some states the police are also able to obtain information on any registered vehicle and licensed driver in the state. The ability of the motor vehicles department to respond to special requests—such as providing a list of light-green two-door sedans with 5 as the last digit of the state license—is critically important to law-enforcement agencies. In some instances the information requested may be simply unavailable; in others police wait six weeks or more while special-purpose computer programs are written and used. Obviously there are states that still need to develop a generalized search-and-retrieval capability for motor vehicle data.

Computers can also be used as laboratory tools providing police with detailed information on such diverse items as fingerprints, fibers, firearms, blood, hair, minerals, vegetables, paper, paint, stains, and tools. In New York State, there are 41 facsimile installations which transmit fingerprints to the State Identification and Intelligence System. Upon receiving and classifying a set of fingerprints, the system conducts an automated search to determine if the individual has a prior criminal history on file. If so, a computer-printed summary of the individual's criminal history is transmitted to the law enforcement agency which requested the fingerprint search. The U.S. Department of Justice has developed a prototype organized-crime intelligence system which it plans to make available to the states.

The growing congestion of both criminal and civil cases in the courts is a widely recognized problem. In one state the Superior Courts are staggering under a backlog of over 18,000 untried criminal indictments or complaints (including more than 100 pending capital cases). On the civil side over 65,000 cases are pending and untried. A 40-month wait for trial is common.

Computer systems cannot substitute for badly needed additional judges and other court personnel, but they can help to reduce the amount of time lost both by witnesses and by the courts due to inadequate information handling and inefficient case scheduling. State governments are coming increasingly to realize that to have a statewide police telecommunications network without having a well administered court system is, in effect, to have very little.

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TUESDAY								
* AUGUST 17, 1971 *								

			104019 7	NASSAU FURNITURE CO		104402 8	KEYSER	ET AL
				V. STEARMAN REALTY CO			V. HARTFORD BD TAX REV	
			06-03-71			06-10-71		
			ROGIN,N C L & B	GILMAN & M		WILSON, A & C		HTFD CORP CNSL
*****			*****			*****		
103942 3	SECURITY INSURANCE		101051 D	KING		100707 6	BISSELL	
	V. PHOENIX INS. COMPANY			V. WAINMAN			V. ROURKE	
06-10-71			06-24-71	GERSTEN,B & G		06-17-71		
TULIN,S&W	COONEY & S		G.A. DOWNING			DADDARIO,S,J & S	F.C. SHEA	
*****			*****			*****		
095402 0	CAPURSO		*****			*****		
	V. MCDERMOTT	ET AL	103326 3	DONOR		104147 9	PROSPECT SALES CO IN	
06-17-71	PT			V. NIXON			V. BERSON	
KOSKOFF & M	R. SCHATZ		06-24-71			06-17-71		
	SCHATZ,W & S		L & R DUNN	PT		D.O. SCHWEITZER	STONER,G & K	AVAILABLE
*****			*****			*****		
101653 9	WIRZULIS		104431 1	MILLER		104398 6	ADVENT CHRIST CHURCH	
	V. DAIGLE			V. HARTFORD BD TAX REV			V. HARTFORD ZBA	
06-17-71			05-06-71			06-17-71		
T.C. URBAN	DOWLING & C		ROGIN,N C L & B	HTFD CORP CNSL		BERMAN & B	HTFD CORP CNSL	
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103752 8	MOTTS SUPERMARKETS		104433 8	MILLER		104249 1	STEINBERG	
	V. TRAVELERS INSURANCE			V. HARTFORD BD TAX REV			V. HARTFORD BD TAX REV	
06-17-71			05-06-71			06-24-71		
WOLFE & MOTT	DANAHER,L & T		ROGIN,N C L & B	HTFD CORP CNSL		FRANCIS,K & O	HTFD CORP CNSL	
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102251 2	SAUNDERS		103699 8	BELSKY	ET AL	104622 5	BAYER	ET AL
	V. SOLOMONSON	ET AL		V. APTER	ET AL		V. MANCHESTER BD TAX R	
05-27-71	PT		05-19-71			06-24-71		
GERSTEN,B & G	A.F. BAYER		R.L. HURNEY	PT		BAYER, P & S	MANCH. CRP. CSL.	
	B. POLINER			REGNIER,M & T				
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104432 D	SHAW-WALKER CO		102492 2	DONAROMA		104796 5	LEVINE	ET AL
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ROGIN,N C L & B	HTFD CORP CNSL		N. EBENSTEIN	M CLIFFORD		ROGIN,N C L & B	HTFD CORP CNSL	
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PAGE 1
HARTFORD COMMON PLEAS COURT CASES

PAGE 2

PAGE 3

This court calendar was compiled by the automatic information system being developed for the Connecticut Superior

and Common Pleas Courts. "To have a state-wide police telecommunications network without having a well admin-

istered court system is, in effect, to have very little," writes the author.

Transportation and Construction

State governments have traditionally equated transportation planning with highway planning. In most of the states, highway departments are using computer models to convert origin/destination data into highway traffic densities. Indiana's State Highway Commission has used a computer-assisted route location

system to generate comparisons of alternative corridors in terms of earthwork, pavement construction and right-of-way acquisition costs. The automated creation of maps from aerial photographs has drastically reduced the amount of field surveying work done by the Texas Highway Department, while in that and other states district engineers

are solving routine highway design problems using remote computer terminals and civil-engineering calculation programs such as those developed at the Massachusetts Institute of Technology.

Nevertheless, the states make little use of computers for other kinds of transportation planning. They could well be used for modelling mass-

transit, air, rail and port development; indeed, it is unlikely that such models can be developed at all without the use of computers. Manual processing of the data required for fully rational transport planning would be (assuming it were possible) prohibitively expensive.

In a number of states there is a backlog in the disbursement of design and construction funds by bureaus of building construction. One state now requires more than a year longer to disburse appropriated funds than a decade ago, and the backlog is itself costing over \$5,000 per day. An automated data processing system could greatly reduce these delays: one proposed system would accurately control accounts, maintain a central file of project records, estimate the cost of construction projects prior to appropriation, prepare and monitor a detailed schedule of all actions required to complete a project, and monitor construction progress. As an aid in the future selection of designers and contractors, the system would also evaluate actual performance.

Computer-based project management could lessen the need for state governments to hire consulting firms to supervise the work of designers and contractors. One state is reported to have agreed to a cost-plus contract that could result in a consulting firm receiving up to \$30 million for supervising a project costing an estimated \$600 million. While on a percentage basis this fee may not seem unreasonable, it is quite possible that computer-based management could have eliminated or markedly reduced the expense.

The preceding discussion of computer applications in state government has been far from comprehensive. For example, state governments could also use computers in such varied functions as designing buildings, allocating office space, reducing the incidence of lead poisoning, maintaining inventories of capital equipment, preparing purchase orders, allocating civil-defense resources, developing contingency plans for natural disasters, maintaining lists of voters, insuring that automated vote-count systems are protected against deliberate fraud, making publicly available all state-agency regulations applying to the general public, and protecting the

public against computer-assisted harassment.

Maintaining Privacy and Security

In many present and potential applications—especially in information systems dealing with criminal history and suspected criminal activity—careful attention must be paid to maintaining security of computerized data. This applies especially to applications directly affecting people.

On the other hand, properly used, the computer can serve as a powerful protector of individual rights. Data now being computerized has often hitherto existed in manual files—sometimes open to view by any staff member or casual visitor, irrespective of his need to know. One state maintains a file of individual court appearances on an estimated five million index cards; in others, arrest histories and court records have been illegally sold to credit bureaus, banks, and brokerage houses. Computerized data, in contrast to legible paperwork, is inherently less accessible to casual inspection; and it can be coded so that information obtained by tapping a data file is indecipherable except to those familiar with the system.

Automated checking on the validity of data, and automatic purging of data, are possible with computer systems. And the computer itself can be programmed to keep track of persons having the right of access to its data, to maintain information on who accessed the data and when, and to automatically check the identification of persons requesting information by means of fingerprint and/or voice-print comparisons.

Towards Real Competence

Although computers are being applied in all areas of state government, the application is often neither efficient nor effective. Among the reasons commonly cited for a state's inability to fully avail itself of the benefits of A.D.P. are lack of competent personnel, lack of central control of A.D.P. work, lack of funds, lack of understanding of the field, unwillingness to share facilities, and resistance to change.

It is true that relatively small direct savings are to be derived from the competent management of a given set of A.D.P. activities (costing only a few million dollars

a year). But in many states these apparently modest savings have been confused with the invaluable benefits to be derived from the effective use of computers as a tool for decision-making. Some state officials, underestimating these benefits, have felt unwilling to confront the political costs of establishing effective central control over A.D.P. activities.

But very different reasons have also occasionally prevailed, when state officials understand only too well the implications of establishing central control over the acquisition and operation of their computers. Such officials would rather, for example, that an inept finance-department A.D.P. section spend millions on failing to develop an automated financial information system than that a technically competent central authority should succeed; for the latter would facilitate the auditing of state accounts and expose the actions of agency heads, legislative committee chairmen, and others to public view. Also, a central authority might not respond to political patronage in filling technical positions as readily as the more politically dependent agencies. And a competent state A.D.P. authority would surely insist on open competitive bidding on all contracts for computing equipment, supplies and services. In states where A.D.P. contracts are presently awarded on a sole-source basis with few if any questions asked, such a development might not be welcome.

In some states, a history of incompetent A.D.P. management has made some officials skeptical of ever successfully implementing any but the most routine computer applications. Under these conditions state managements have sometimes become so wrapped up in the intricacies of their computer operations that instead of insisting on visible progress and demanding personal accountability for the achievement of objectives, they have become inured to delays and difficulties. What they fail to see is that if the application of computers in state government is to be effective, a strong, technically-competent central A.D.P. authority is a necessity. Automated information systems alone cannot solve the problems facing state government, but the proper use of such systems can help to make government more responsive and efficient.

Local Politics and Air Pollution

There is little doubt that increasing air pollution in many regions of the nation is an assault on our sensibilities and may be a threat to public health. Current economic loss to agriculture, industry, and private citizens is well documented. The present concern about air pollution has encouraged many scientists and engineers to voice their opinions on the public platform.

Industry's reluctance to implement effective self-regulation, either over its direct contributions to air pollution or over its pollution-contributing products, has forced the issue into the political arena. Frequently issues involve such strong political and economic pressures that only volunteers are in a position to speak objectively. Substantial volunteer efforts are therefore necessary by technically trained individuals, to convey to the public a balanced view of the problem and the possible modes of its resolution. The need is particularly acute for local problems, where the smaller government agencies have inadequate technical capabilities.

Public education often does not result in public action; so those technologists with strong convictions and tolerant wives have occasionally tried, in citizens' groups, to wield power on the political level. Such efforts involve the interplay of technical and political considerations: the inevitable "real world" necessities of value judgements and invitations to compromise. Successful introduction of new concepts for air pollution controls may be possible only through compromise. And political acceptability will influence the future trends of air pollution technology, as well as the goals and course of the citizens' group.

My own experience led me to ex-

amine the general concepts upon which air pollution control ordinances are based and how their introduction may be influenced by political factors. I became particularly involved in the problem of stationary sources, such as power plants, refineries, and incinerators. These are the most important contributors to air pollution in many communities. In contrast with the control of emissions from motor vehicles, the control of stationary sources is a matter that can be handled by local governments, the cities and counties. Unfortunately, the control ordinances of most local governments are shockingly inadequate. The concepts which have been applied to restricting emissions will not serve to secure the long-range goals now enunciated by the popular press and environmentalists. It is, I found, easy to demand "clean air" and usually difficult to design ordinances to insure its attainment.

California—Out in Front, but . . .

My perspective developed in California during a year's activity in a citizens' group in coastal Ventura County. The group sought to stimulate the County Board of Supervisors to establish a novel emission standard on nitrogen oxides before construction was begun on one of a series of 790-Mw. fossil-fuel power plants. We were brought up squarely against some of the more crucial political problems, even though California in many ways pioneers the nation's efforts in air pollution controls and enforcement.

Perhaps a brief sketch of the present air pollution control organization in California will indicate where various political influences play dominant roles. The choice of California as an example does not imply that

the division of responsibility in that state is necessarily ideal. The existing organization has many weaknesses. However, the California system has evolved over a number of years and has responded to a citizenry that is perhaps the country's best-educated on air pollution concepts.

In 1967 the state legislature established, by the Mulford-Carrell Act, what has become the Air Resources Board within the Department of Public Health. The Board was given authority to establish statewide air quality standards, to develop and implement emission controls for motor vehicles, and to develop effective programs for the control of non-vehicular sources of pollution within the state.

Regional Air Pollution Control Districts (A.P.C.D.'s) were organized to formulate and enforce air pollution emission controls on stationary sources within their regions. In practice, the boundaries of the A.P.C.D.'s coincide with county boundaries. This division has an evident weakness, since winds do not recognize such boundaries. (The coming fashion, however, tends toward boundaries defined by meteorological factors, as recommended by the National Air Pollution Control Administration.) In each A.P.C.D. the county Board of Supervisors has acted as the Air Pollution Control District Board, the political body charged with the responsibility of setting emission standards and with the supervision of their enforcement through the professional county administration. It is evident that effective emission controls are possible only if the Supervisors so choose. The essence of the California plan was "home rule," with the Air Resources Board reserving the right to

Even with laws enacted on higher levels against pollution, the local government does not necessarily plan the best controls for its area. But citizen pressure, particularly that backed by technical knowledge, can assist and persuade

intervene in a local situation when necessary.

Defining "Dirty Air"

Coastal California's air quality being what it is, the Air Resources Board had little difficulty in attracting highly capable technical experts, physicians, and scientists to serve on its technical advisory committee. The board has established ambient air quality standards for most toxic gases on the basis of known adverse effects, and it has thereby provided a technical definition for what we might loosely call "dirty air." In principle, each A.P.C.D. should strive to maintain pollutant concentrations not exceeding the adverse levels of the air quality standards. Some have a long way to go. Los Angeles County, for example, is reported in 1969 to have exceeded the nitrogen dioxide level 140 days; the oxidant level, 250 days; the sulfur dioxide level, 115 days; and the particulate standard, 360 days. At the time of this writing air quality standards are also being formulated by the National Air Pollution Control Administration, but as yet national standards have had no significant influence on the establishment of air pollution controls at the local level in California.

Local A.P.C.D.'s have the option of defining even more conservative air quality standards than have been set by the Air Resources Board. Few have exploited this possibility. One county that did was motivated by agricultural interests who wanted a tougher standard for sulfur dioxide. Setting such standards involves economic and political factors, for the only way to respect the standards is to correspondingly restrict the emissions of pollutants in the locality. Several key questions are usually



The author drew this sketch to describe the situation of a technologist with "strong convictions" and a "tolerant wife," participating in the interplay be-

tween the technical and the political in a California community trying to control air pollution.

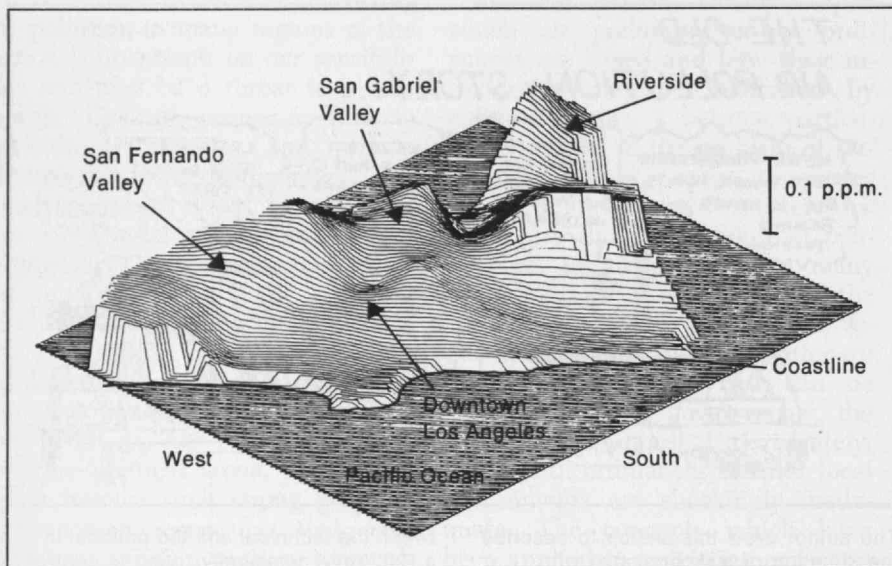
considered when setting standards, including:

- ☐ What degree of conservatism should be factored into the "adverse" levels for humans, when the only data available on toxic effects may be from studies on lower animals?
- ☐ What fraction of the population should be protected?
- ☐ Should agricultural interests be preserved, in which case some pollutant levels would be more restricted than if based solely upon toxicity to humans?
- ☐ What weight should be given to psychological factors, for example, reduction of visibility as a result of the scattering of light by aerosols?
- ☐ What economic or social impact may result from a given restriction?

The answers are obviously sensitive to local values. Will agriculture be allowed to suffer by setting standards that cause the least resistance

to industrial development? Will a tax increase be needed to improve a city's incinerator in order to meet a restriction on the amount of suspended particulate matter in the air? If these trade-off questions are not considered when *ambient* standards are set, they will certainly be a factor when *source emission* standards are devised. Standards generally considered to be too restrictive when weighed against economic factors may not be enforced.

The A.P.C.D. "home rule" concept has a serious inadequacy: the lack of technical information input into local decisions. In theory, when formulating standards, the Board of Supervisors considers the advice of its air pollution control engineers, the political climate, economic factors, and the advice of a citizens' advisory committee. The latter body, its members appointed by the supervisors, assumes some responsibility



The complexity of pollution diffusion modeling is illustrated by this distribution of oxidant in the South Coast Air Basin of Los Angeles at 8 a.m. on August 21, 1969, as inferred from measurements. Oxidant concentrations for regions above 500 meters altitude are arbitrarily set equal to zero, as they are for regions over the Pacific Ocean. The two troughs extending from the background mountains

in the Northeast toward the coastline in the foreground show the effect of drainage winds from the high desert of inland California and Nevada. Substantial buildup of pollution occurs in the more stagnant air within the San Fernando Valley and Riverside area. (Illustration: Environmental System Research Institute, Redlands, Calif.)

for considering economic and political as well as medical issues. In that sense it provides an input from the business community and citizens at large. Often these advisory committees make an effective lobby for industry, their membership heavily biased by the appointment process. One supervisor refuted criticism of the makeup of one committee with the comment that in his view it was desirable to have "the overall makeup of the committee nicely balanced." However, insight into the implications of this policy is provided by a newspaper editor's interpretation that "balanced" appeared to him to mean balanced between members with a conflict-of-

interest and those without!

Lack of good technical input may be particularly acute in small counties in which the professional staff has inadequate training, or in counties in which the staff dares not offer its objective opinion. There is then a real need for the services of competent volunteers.

Solution—Dilution?

Once air quality standards are established, the task is to control the quantity and distribution of pollutant emissions in order not to exceed the ambient adverse levels. Almost universally, the accepted solution (and the most straightforward) has been to set a maximum permitted

concentration for each pollutant emitted in the exhaust gas of each source or exhaust stack. This strategy fits the oft-quoted philosophy that "the solution to pollution is dilution."

Thus the *maximum concentration* standard came into being. It has the superficial simplicity that the units for the maximum concentration of pollutants in a stack exhaust usually expressed as "parts per million" or p.p.m. for gaseous pollutants, are the same units used to denote adverse levels in most air quality standards for toxic gases. An A.P.C.D. may limit the sulfur dioxide output from a stack to be less than 250 p.p.m., anticipating that all exhaust plumes will be sufficiently diluted through mixing with the surrounding air to maintain a concentration at ground level satisfying an air quality standard of, say, 0.1 p.p.m. Unfortunately, a simple limit on the concentration of a pollutant in the effluent neglects the multitude of variations in meteorological conditions that affect the dilution of a plume before it touches ground. Diffusion theory as generally applied in fact predicts that the maximum ground level concentration from a plume of neutral buoyancy released from a stack is not directly related to the concentration of the pollutant in the stack exhaust; instead it is proportional to the total rate at which the pollutant is emitted—the mass emission rate. Yet concentration restrictions are all that most localities impose—if any at all are imposed.

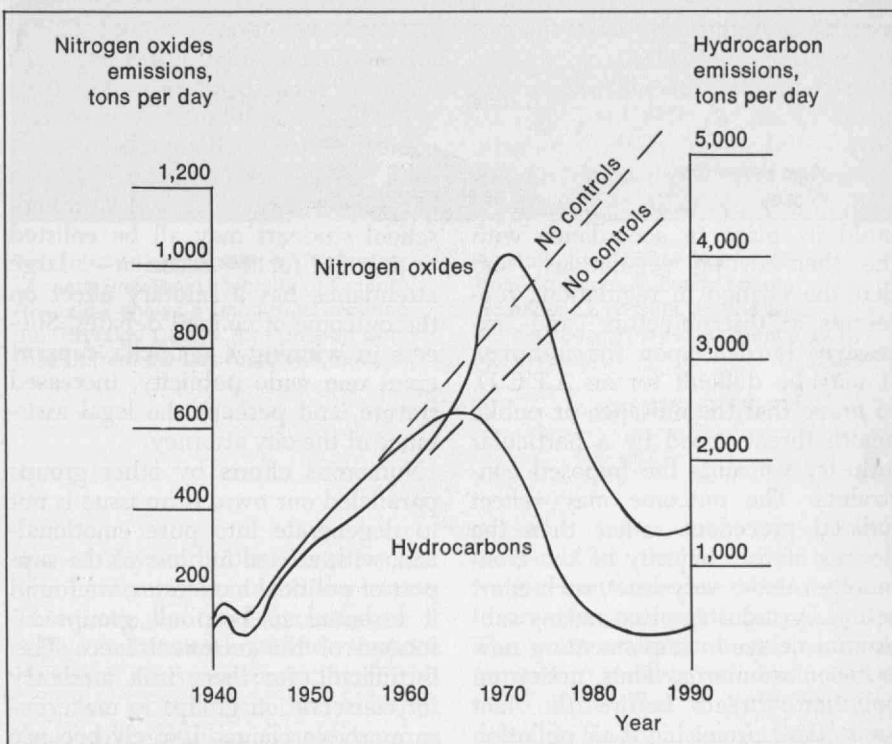
During the past decade, several variations of the maximum concentration emission standard have been built into ordinances. One example is a limit on the percentage of sulfur which is permitted in fossil fuels,

Community organization to stem air pollution has a serious inadequacy: the lack of technical information input into local decisions. There is a real need for the services of competent volunteers

in effect a limit on the concentration of sulfur dioxide in the exhaust. Another example is a maximum permitted mass concentration of particulate matter in an exhaust. Some states permit hotter plumes, which rise by their buoyancy, to contain a higher concentration of particulate matter, since the exhaust is better mixed with the surrounding air before it reaches ground level. None of these standards, however, meets the needs of communities where pollutants may accumulate for several days during stagnant conditions. Then the parameter of concern is the *total mass* of each pollutant which has been emitted or the rate at which the pollutant is emitted, not just the *concentrations* in the exhaust stacks.

Mass Emission Limitation for NO_x

Southern Ventura County is an air basin much like the Los Angeles Basin. On most days air contaminants are trapped underneath an elevated inversion layer, and during conditions of poor horizontal ventilation, pollutants accumulate. Several years ago an issue developed over a proposed gas or oil burning power plant which an electric utility intended to construct at the mouth of the air basin. This is not the appropriate time to discuss the details of the pollution threat. I shall say only that a number of scientists and engineers concluded that the county could best protect the public by initiating a limitation on the mass emission rate for nitrogen oxides. This would set a maximum rate at which nitrogen oxides could be emitted by any individual source. To my knowledge no other governmental body in the world had set the precedent with a previous mass emission limit on any gaseous pol-



Projected daily emissions of nitrogen oxides and hydrocarbons from the California South Coast Basin. Hydrocarbon emissions dropped sharply after 1966 as a result of implementation of automobile emission standards. Auto manu-

facturers responded to these controls with engines that put out more NO_x, as the curve shows, but these emissions should also drop sharply as NO_x also is controlled. More people with more cars will turn the curve up again in the 1980's.

lutant from stationary sources.

Delegates of several citizens' committees appeared before the Board of Supervisors to recommend emission standards or express opposition to construction of the plant. But nothing substantial resulted from this direct approach. We had no effective political pressure when contrasted with the influence of the utility, the largest single taxpayer of the county. So much for the strength of technical facts alone! A number of scientists and engineers from local schools, industries, and armed forces installations be-

came so concerned over the situation that we decided to complete in-depth technical studies and initiate a campaign to have effective emission standards introduced. Our committee adopted a strategy that exploited the principle of leverage. We sought to enlist the aid of other groups which could enhance our image and provide useful assistance. The political goals were to convince the supervisors of our overwhelming grass-roots support; to portray our recommendations as politically attractive by enlisting the sympathy of state political figures; and to ini-

tiate legal actions to stall Public Utilities Commission approval of the plant until the first two goals were met.

If successful, these factors should insure passage of workable controls over emissions. The time element is important, for emission standards can be most effectively implemented when adopted *before* a polluter begins operations. The point is worth a brief digression.

A Priori Standards

Imposition of more stringent emission standards on an existing source might well encounter difficulties with "grandfather clauses" if the cost of meeting the standards is considered by the affected industry to be excessive. By this tactic, an industry can appeal to the courts on the basis that a substantial investment had previously been made to build its plant in accordance with the then-existing regulations; and that the change in regulations represents a "discriminatory" and "excessive" burden upon the industry. It may be difficult for an A.P.C.D. to *prove* that the nuisance or public health threat posed by a particular industry warrants the imposed constraints. The outcome may reflect judicial precedent rather than the desires of the majority of the community. At the very least, such court action by industry often means substantial delays in implementing new emission standards. Thus, action on pollution threats before the fact seems most promising if air pollution control is to successfully reflect local societal values.

It is perhaps easy to believe that meeting the pollution problem before a source is operating may not be so important if existing sources can be controlled in accordance with changing meteorology and ambient pollution levels. This might mean changes based upon hourly monitoring of ambient air quality, and inconvenience to industry only during episodes of abnormal pollution. But industrial output is not easily regulated on an hourly basis, and a fair system for assessing pollutant reductions during periods of high ambient levels seems beyond present political capabilities. Shutdown of industry is a means of last resort. Los Angeles, for example, has never required industries or utilities to reduce pollutant output on even the smoggiest of days.

A Campaign Plan

So, with the time element in mind we set out to build a political climate in Ventura County which would stimulate passage of a mass emission standard. We by-passed the traditional civic organizations, for they were controlled by vested interests. Instead we singled out city councils for emphasis. We found the assistance of a local political expert essential for the early work. Personal appearances, debates with utility representatives, and appeals for resolutions were effective in many cases. Councilmen are more willing to believe private citizens who have no financial interest at stake. This is an advantage that citizens' groups have over company representatives and hired consultants. A necessary catalyst is a council chamber packed with "concerned citizens." Garden clubs, conservation groups, and high school students may all be enlisted to turn out for the occasion—a large attendance has a salutary effect on the outcome of council debates. Success in winning a council's support gives one wide publicity, increased stature, and perhaps the legal assistance of the city attorney.

Numerous efforts by other groups paralleled our own. If an issue is not to degenerate into pure emotionalism, with a resulting loss of the support of political moderates, we found it essential to keep all groups informed of the technical facts. This is difficult, for there is a tendency for conservation groups to make unsupportable claims. Largely because of our continual communication between groups, we avoided destructive fractionalization, although not everyone pursued the same goal.

After six months of effort, the accumulated support from city councils, newspaper editors, the County Medical Society, conservation clubs, the state senator and assemblyman, and the A.P.C.D. advisory committee made a mass flow limitation politically acceptable to the Board of Supervisors. The A.P.C.D. passed a dual ordinance with a maximum concentration clause limiting nitrogen oxide emissions to less than 250 p.p.m. at the stack and a mass emission clause limiting emissions to less than 20 tons per day (as all NO_x) per source. The mass emission standard was less restrictive than we had hoped, but we could not gather enough votes from the A.P.C.D. advisory committee to have a lower

one recommended. The precedent alone was important, for it was politically *unacceptable* for the counties to the southeast to have less stringent regulations than their neighbors. Within two months Los Angeles and Orange Counties followed with similar mass emission limitations on new sources, but decreased the limit by more than an order of magnitude. This drastic reduction, in effect, bans new large fossil-fuel power plants.

Are We Protected?

Emission standards often represent the current state of technology. In many localities they are imposed with only the major polluters in mind, and smaller concerns have to follow suit. Usually there is no relationship between emission standards and subsequent ground level concentrations in the exhaust from the smaller concerns—a definite weakness. Logically, the design of each emission source should be examined before construction to insure that, when it is added to existing sources, the air quality standards will not be violated. Yet to apply this process to each new source would require an A.P.C.D. to have an engineering department of massive size. Nowhere in the nation is this done. To insure only that the stack emission standards are not violated by new and existing sources currently requires in Los Angeles County alone a staff of over 60 engineers and a gross A.P.C.D. budget of almost \$5 million per year.

Added to the financial problem of insuring that new sources respect ambient standards is a technical one: the theory of plume diffusion from a source is still in a very approximative state. Under the most favorable conditions, one cannot expect ground level concentrations to be predicted with an accuracy better than a factor of two or three. Furthermore, the meteorology of most localities is imperfectly understood; quantitative data for the frequency of occurrence of different wind and stability conditions are often nonexistent.

These difficulties are reflected in the lack of ordinances that require new sources to respect ambient air quality standards. I know of no ordinance that requires a polluter to limit its output so that its plume at ground level will not violate an air quality standard anywhere beyond

its property line. The difficulty of preserving ambient air quality through single source emission standards is especially evident in heavily industrialized regions with multiple sources. Exhaust plumes from many stacks can overlap downwind; the total ground level concentration can exceed the adverse level even though the output from each individual stack does not. In such situations it is difficult if not impossible to assess the damage caused by a particular source. An extreme example is damage caused by photochemical smog. Many of its toxic components are created by reactions within the atmosphere. Modeling studies of pollution dispersal in such circumstances must incorporate numerous complex factors if their results are to be credible.

Comprehensive Controls

Our cities need comprehensive emission controls. Not only must emissions in many localities be scaled down to meet state or federal standards, but beyond that the consequence of admitting new sources into a community must be faced. Is it practical to deal with the case of direct downwind pollution from several stacks by an emission standard which sets a maximum *source emission density*? Could we, for example, permit up to two tons per day of sulfur dioxide to be emitted from each square mile of ground area? For meteorological air basins, could we set a maximum mass emission rate from all sources? Addition of new sources into a region might then require a reduction of pollutant emissions from all existing sources, to comply with either of these comprehensive limitations. Some observers will argue that such concepts are too simplistic for adequate and equitable restrictions. But perhaps at least such concepts serve as guidelines. The formulation of comprehensive standards is a modern frontier in political-technical problem solving.

It seems that no practical way presently exists to ensure that ambient air quality standards in complex situations will be respected, except by the forceful political action of concerned citizens in individual cases. In over-polluted regions, the recourse might be to opt for the simplest alternative and require an across-the-board reduction in mass emission rates or oppose construc-



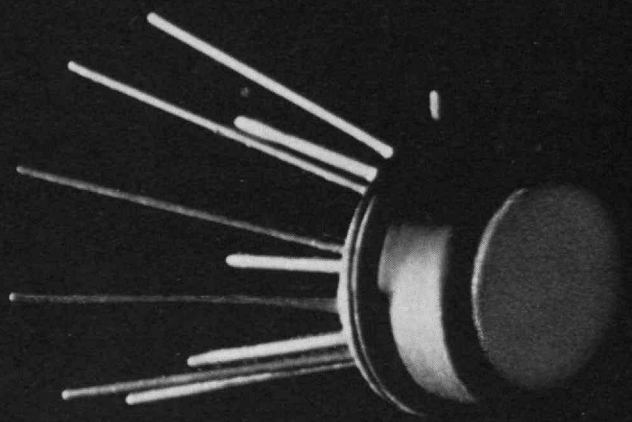
This infrared photograph by Professor Leonard Bowden, University of California, Riverside, shows a smog front invading the Riverside County Air Pollution Control District from the Los Angeles County

Air Pollution Control District. (Photo from *Advances in Environmental Sciences*, J. N. Pitts, Jr. and R. L. Metcalf, eds., Wiley-Interscience, N.Y., 1969, Vol. 1.)

tion of any additional large source. The latter appears to be the vogue. The tactic can be successful if it enjoys substantial public support. However in some cases even this may not be sufficient. For example, the Public Utilities Commission in California has taken the position that it alone has the authority to decide whether a power plant will be constructed. The A.P.C.D., it claims, has only an advisory role. Thus a local air pollution issue would not be decided solely upon the community values, but would be weighed against statewide need for economical and reliable power. This position, successfully maintained, can seriously affect the efforts of local agencies to control pollution within their boundaries. However a 1971 decision by the California Supreme Court supports A.P.C.D. authority over power plants to the extent that new plants are required to obey both A.P.C.D. and Public Utilities Commission regulations.

In conclusion, I wish to emphasize how shockingly simple are the concepts which have been applied as emission standards on pollution

sources. Only the maximum concentration limitation has been imposed to any great extent for toxic gases. The mass emission limitation is an important innovation and makes more sense from the standpoint of diffusion theory in some applications. But neither ensures compliance with ambient air quality standards unless specifically designed to do so. No ordinance is known that requires the contaminants in the effluent of a new source, when added to existing pollution concentrations, to comply with air quality standards. Consequently, comprehensive planning is almost totally ignored. A major factor which hinders broad limitations, such as maximum source densities or maximum total emissions from a geographical region, is the extreme reluctance of most local political bodies to accept any ordinance that restricts or imposes a ceiling on industrial development. This is a political fact of life. It should be clear that significant advances—both technical and political—must be achieved before we can be safeguarded by comprehensive air pollution controls.



IF IT WORKS ON THE MOON, IT

That cylinder, the size of a pea, is a building block of all space-age electronics gear. Soon millions will put more zip in your mail. And nickel's helping make it happen.

The U.S. Postal Service is busily streamlining itself with some of the most sophisticated electronic hardware in—or out of—this world.

Optical scanners to decipher addresses in over 10 different type fonts. Computers. Coders. High-speed printers. Giant, 15-ton electro-mechanical sorters.

By 1975, this equipment should begin to slash postal operating expenses as much as \$500 million a year. And make a whopping improvement in service.

At the core of the new machines—and of business, medical, aerospace, and other advanced electronic hardware—are millions of spidery gadgets like the one in our photo. Anywhere from 29 to 100 percent nickel, they're hermetically sealed *packages* for miniaturized components. Most house tiny chips of silicon covered with transistors, resistors, diodes, and complex circuitry—complete *systems* for storing, amplifying, and otherwise harnessing faint electronic impulses.

The nickel in the packages helps because it has

SHOULD WORK IN THE POST OFFICE.

good thermal and chemical compatibility with silicon. Because it enhances formability, bonding, and electrical conductivity. And because corrosive humidity won't faze it. (Nor snow, nor rain, nor heat, nor gloom of night, for that matter.)

Insignificant as the little cylinder looks, it took over 4,000,000 pounds of nickel to make enough of them for the electronics industry last year.

Just as our metal is a helper, so International Nickel is a helper. We assist dozens of different industries all over the world in the use of metals. We offer technical information. And the benefit of our experience. Often, Inco metallurgists are actually able to anticipate alloys that will be needed in the future, and to set about creating them.

This kind of helpfulness, we figure, will encourage our customers to keep coming back to us.

And that helps all around.

The International Nickel Company, Inc., New

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INTERNATIONAL NICKEL HELPS

Trend of Affairs

Trends This Month

TRANSPORT

Urban mass transit problems have a long history . . . and plans for the future have too little practicality, too much "Buck Rogers".

AVIATION

Can short-take-off, close-to-the-city aircraft be made quiet enough? . . . The aircraft industry sees growth resuming . . . but with less help from D.O.D.

ENERGY

A superconductive rotor for tomorrow's giant generators . . . New England's power troubles—and hopes.

THE MOON

Lunar seismology looks through the layers.

SOCIETY

How technology has affected our lives is anyone's guess, as research on it dwindles . . . Mathematical models of society may ignore vital subtleties of life.

LIFE SCIENCES

A Nobellist's theory on why chromosomes look the way they do . . . Does anyone know what people should eat?

EDUCATION

Industry gives less: of which, textiles give most . . . M.I.T.'s "open university" concept includes learning-at-work . . . Neither students nor administrators really plan ahead.

TRANSPORT

Urban Transit: In a Jam Yesterday . . .

Deficits and bankruptcy in urban mass transit operations are nothing new after all.

As early as 1919, one-third of the operating companies were bankrupt. The situation was so serious President Wilson deemed it necessary to appoint a Federal Electric Railway Commission to investigate and publicize the plight of the urban transit industry.

Indeed, says a report from M.I.T.'s Urban Systems Laboratory, "U.S. revenue transit ridership has followed a slow and predictable rate of decline since well before the automobile had its major impact. . . . Further investigation of the transit industry's complex financial history might well reveal that few, if any, operations ever made large profits from transit operation alone over sustained periods."

Authors Richard Solomon and Arthur Saltzman give four fundamental reasons for the decline:

□ Inflexible fare structures kept revenues steady while operating costs (especially wages) increased severely. In addition, overcapitalization based on unrealized anticipations of growth in ridership drove many operations to bankruptcy.

□ The transit industry has been unable to respond to changing public needs because of exclusive franchises and a lag in adapting new technology.

□ The Securities and Exchange Commission interpreted the Public Utilities Holding Company Act of 1935 as prohibiting most electric power and petroleum trusts from keeping their wide-ranging financial interests in transit operations. This denied to the transit industry not only capital but also management aid just when they were most needed to support modernization.

□ The same pattern recurred when anti-trust actions by the Justice De-

partment broke up the practice of stock ownership in transit companies by major equipment suppliers. These suppliers had underwritten street-railway replacement from about 1936.

Curiously though, the report emphasized, some kinds of mass transit have endured. In the years before World War I, modified 5- or 6-passenger touring cars were picking up passengers along downtown trolley routes in many cities. The "jitneys," as they were called, prospered to the extent of diverting about 50 per cent of peak-hour streetcar passengers. The street-railway operators countered by legislating and regulating the jitneys out of existence.

Hudson County in New Jersey today has several dozen one and two-vehicle bus operators that started originally with jitneys. Peoria, Ill., Flint, Mich., and Mansfield, Ohio, support profitable bus lines that have good passenger acceptance. And finally, the Urban Systems Laboratory Report describes a self-supporting Reston, Va., express bus to Washington that "seems to violate all the rules for a successful transit operation. . ." The report states that "it was citizen initiative which brought about the success of the Reston Express Bus—their bus.

"Such identification with an operation strikes a familiar note—the popularity of the jitneys 50 years ago was in part due to their image of being closer to their passengers, the reverse of the 'transit trust' image of the trolley operators."—*Michael Chiusano*

. . . And "Tomorrow"

The idea that a successful transit system should be "close to the passengers" (see above) was also evident in a speech with which M.I.T.'s Professor Michael Godfrey "startled" a Minneapolis conference on personal rapid transit. The "technomania" of today's transit technologists, he suggested, overlooks the tough, human problems of urban transportation. Transportation must be integrated with other public

facilities and cannot by itself achieve urban development objectives.

A four-column article appearing in the *St. Paul Pioneer Press* quotes Professor Godfrey thus: "Transit engineers should not prescribe new forms of technology as painless solutions to rush-hour congestion, air pollution, pedestrian mobility and isolation of the poor, aged, and other non-drivers. Technological imaginations of engineers and planners have taken flight into the never-never land of linear motors, air-bearing suspensions, master mode-mixers, space-age styling and like fancies. Whatever focus there was on the (urban) problem was blurred by the prospects of spanning whole cities in a single 60 m.p.h. leap."

The conference, on the whole, reacted negatively to Professor Godfrey's remarks; some accused him of being "unprofessional" in his presentation. This cool reaction, Dr. Godfrey comments, was perhaps not unrelated to the desire of the participants to sell their own "innovative" systems.

Opinions differed. At least one conference attendee felt compelled to write to Professor Godfrey describing his presentation as "the absolute high point of the conference."—*Michael Chiusano*

AVIATION

Prospects for Short Take-Off . . .

What about V/STOL (vertical or short take-off and landing aircraft)?

V/STOL is a rather broad concept, including aircraft which require no runway (like a helicopter) and aircraft which require a run of up to 2,000 ft.—anything which takes appreciably less land than a conventional jet airliner. The idea is to ease the congestion of present-day airports by shifting some of the traffic to smaller landing spaces. These could be quite close to cities (where land is costly) or even on the

roofs of buildings. (M.I.T.'s Professor Rene H. Miller goes further, suggesting a vertical take-off system for a role that is presently exclusive to ground transport—commuting between a city and its suburbs.) Mr. H. Avramito, of the French firm Aerospatiale, estimates that by cutting access time a VTOL or STOL aircraft could make inter-city trips of 250 miles half an hour shorter (where, at present, only 40 per cent of total travelling time is actually spent in the air).

But it is still far from clear what the aircraft themselves will be like. Military developments since the 1950's have provided a number of machines which fit the general description of V/STOL, but civilian requirements are different, and have yet to be fully defined. Only Canada claims a presently operational civilian STOL passenger carrier.

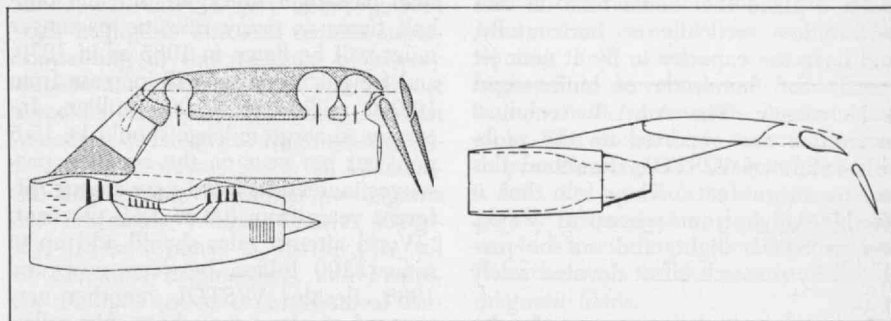
The big problem will be public acceptance. As C. C. Halton of the Ontario Ministry of Transport explained, at the American Institute of Aeronautics and Astronautics 1971 fall meeting, people fear not only that the STOL or VTOL planes will be noisy but also

that a STOLport built near their homes will turn into a larger airport. That fear, he said, breeds reluctance among manufacturers to invest.

Less Noise . . .

The aerospace industry seems to have learned a lesson in public relations from the S.S.T. debate. People are accustomed to one VTOL craft, the helicopter, which is already versatile and widely used, but the helicopter is noisy. Commercial VTOL and STOL will be presented as, and presumably designed as, quiet planes. Some proponents already exhort others to speak of QTOL (Q for quiet). Robert Maxwell of the Department of Transportation sets a noise level at the airport boundary of 80 PNdB as the goal for VTOL or STOL research, which is considerably quieter than present airplanes; the "footprint"—the area in which noise levels are undesirable during take-off and landing—is expected to be from 10 to 30 times smaller, Mr. Avramito said.

However, it was announced in September that N.A.S.A. has begun a STOL aircraft development program,



Versions of the two lift-augmenting ideas on which N.A.S.A. is concentrating, for short-take-off aircraft. The augmentor wing (left): air is diverted from the engine intake, through the wing, to a pair of flaps which deflect it downward. The externally-blown flap (right): engine air exhaust is deflected downward to produce additional lift. Both schemes are inherently noisy, irrespective of how quiet the engine itself may be. (Illustra-

tions: James F. Dugan, Jr., *Astronautics and Aeronautics*, Nov. 1971, pp. 36-45; Robert G. Dorsch et al., A.I.A.A./S.A.E. 7th Propulsion Joint Specialist Conference, Salt Lake City, June 1971)

which could cost \$100 million, concentrating on two lift-augmenting wing-flap systems—the augments wing, which deflects air ducted from the engine's fans down between flaps, and the externally-blown flap, which deflects the engine exhaust. At the 7th Propulsion Joint Specialist Conference in Salt Lake City this summer, a N.A.S.A. team announced that both these flap concepts “will present serious noise problems.” This in spite of the authors’ assumption that the goal was 95 PNdB, not 80, at a 500 ft. sideline.

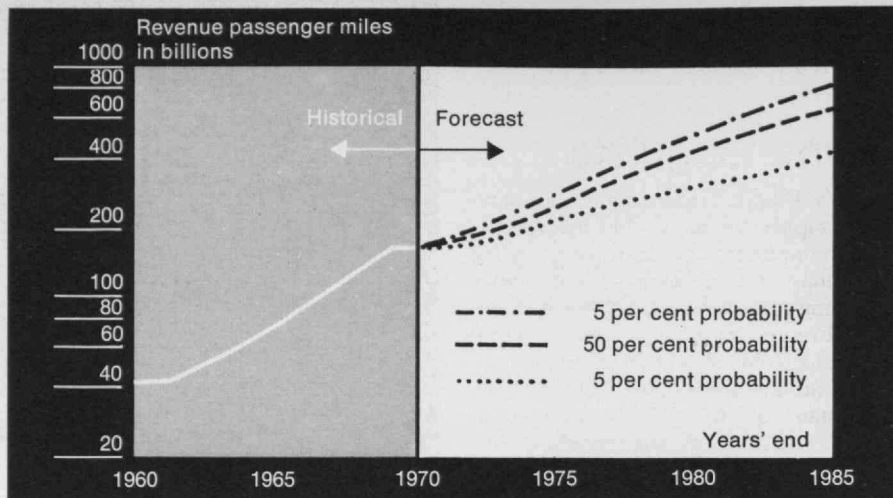
In relation to fly-over noise, one advantage of STOL is the steep ascent and descent (6-12° instead of 2-3°). The optimistic view is that the rest of the problem will yield to hard work: new materials to line engine cases, for example, and (since STOL aircraft are expected to be smaller than conventional airlines) the development of smaller high bypass-ratio engines. (Such efforts have not always been successful: the high-bypass-ratio engine now propelling the wide-bodied jets could be evolved into a smaller model for smaller jets only with five or so years of research. And engineers have yet to find ways to dampen noise from the JT8D engine that powers the 727 and 737.)

... and More Orders

The V/STOL rewards look to be great. The market is expected by the industry to be some 1,000 to 2,000 planes in the 1980's—two to four times the fleet size predicted for the S.S.T. A STOL or VTOL craft is expected to cost half again as much as a conventional plane of the same capacity (the sizes would range from 40 to 60 seats to 100). In the 10 years following the introduction of STOL planes, some estimates show up to \$2 billion in their sales.

Beyond STOL and VTOL there is the possibility of V/STOL in a single aircraft: a plane that could take off and land either vertically or horizontally, and have the capacity to fly at near jet speeds for hundreds of miles—and make money. The A.I.A.A. technical committee that reported on the probable future of V/STOL described this as “no mean feat.” They felt that it would evolve from successful VTOL and/or STOL flight, and not be produced by research effort devoted solely to it.

One experiment in near-the-city STOL service is beginning with the 19-passenger Canadian De Havilland prop-jet Twin Otter, which is well established as a short-haul carrier. The Canadian Government is said to plan demonstration service between Ottawa and Montreal in early 1973. The government already owns sites for the ports close to the downtown areas. It expects about 150,000 passengers a



Possibilities for the growth of the U.S. airline industry, according to the Technical Committee on Aircraft Design of the American Institute of Aeronautics

and Astronautics. The forecast having a 50 per cent probability of being realized is from Boeing and is somewhat less optimistic than others considered.

year, although there is strong competition from trains, busses, autos, and other airplanes. But it hopes the demonstration will prove to the STOLports' neighbors that the service will be quiet. Already the Twin Otter has made flights into an airport near the suburbs of eastern Ottawa and has received scant opposition.

Boeing Shall Rise Again

The airline industry, straitened at the moment, hardly sounded pessimistic at the meeting last fall in Washington of the American Institute of Aeronautics and Astronautics: the A.I.A.A. technical committee on aircraft design filed a report that forecast rates of growth almost like those of the 1960's.

World cargo mileage will grow faster than passenger mileage: four and one-half times as many revenue passenger miles will be flown in 1985 as in 1970, and freight ton-miles will increase from 10,000 million to 88,000 million. Increases in cargo mileage should be 15.5 per cent per year on the average; passenger increases should vary among different years from 8.3 to 12.9 per cent.

World aircraft sales should add up to some \$100 billion between now and 1985. Besides V/STOL, another new type of airplane may be a big seller, the report said: a long range cargo carrier that would be adaptable to passengers.

The report analyzed the airlines' difficulty: the huge growth in the 1960's and the overenthusiastic forecasts and subsequent overstocking of equipment. Earnings have fallen from \$400 million in 1967 to minus \$130 million in the first quarter of 1971. But second quar-

ter earnings seem to be better. Cost per passenger mile to the airline is up 17 per cent since 1960; fares are up 18.5 per cent since 1969. Indeed, the report says, some "special" fares have changed so that a family may now spend 30 to 50 per cent more on a trip today than in the 1960's.

"It is becoming questionable to some," it continues, "whether further fare increases are in the public interest. They will retard traffic growth to the degree that the public is sensitive to travel cost. And the effectiveness of charter travel internationally . . . suggest(s) that the general public is clearly very sensitive to travel cost." The report adds that "it seems logical to assume that much of the current decline in air traffic growth is related to increases in fares. . . ."

Suggested means for holding down fare increases include such short-term economic reliefs as tax reduction, low-interest loans, and temporary suspension of the ticket surtax.

The committee also questioned C.A.B. regulations regarding the interior design of aircraft and the services offered thereon. (The C.A.B. seeks to raise the fare for amenities such as five-abreast seating and coach lounges. Some critics have questioned what they feel is over-management.) "Their position is clearly well-intended," said the committee, from the viewpoint of trying to constrain fares to "the lowest possible reasonable level consistent with provision of adequate minimum service standards."

But—in the rather subtle wording of the report—"different evaluations may be made by travelers and some very cost-effective aircraft may be unfairly penalized. . . ."

The report's concluding statistic puts the whole business in perspective: by

1985, only 6.5 per cent of the world's population will have traveled by air, which is 3.7 times the 1969 figure.

Airline Linguists

M.I.T.'s Flight Transportation Laboratory—supplying men ably trained in using computers for managing airline operations and planning—had better add some new courses to the curriculum: French, German, Russian, Japanese, and Hebrew, among others.

That advice from Secor D. Browne, Chairman of the Civil Aeronautics Board, speaking at the luncheon for members of the M.I.T. Corporation following their annual meeting at M.I.T. on October 8.

The reason: "Our virtual monopoly of the large air transport market is being eroded," said Mr. Browne, and future airline planners will be spending lots of time with overseas suppliers.

This is not because the U.S. aeronautical research and development effort is lacking, nor even specifically because Congress failed to authorize development of the S.S.T. The problem is that the U.S. now has no way to do that part of the aircraft development job previously done by the Department of Defense.

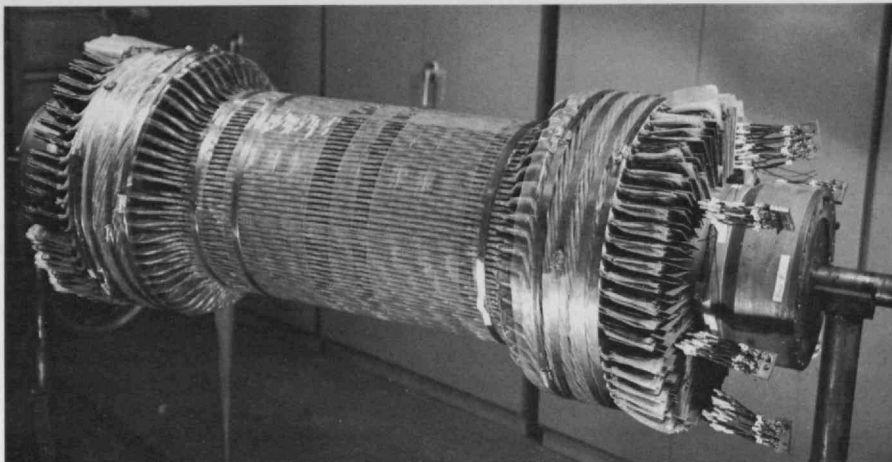
It is no secret that most commercial jet transports—including the 1011 and 747—were the outgrowth of military aircraft and that a large proportion of their development costs have been covered by military requirements. Mr. Browne now seeks some alternative basis for the industry to obtain the immense capital required for development of new aircraft. "The loss of the S.S.T. was not the loss of an aircraft," he said, "but the loss of a mechanism for providing this economic support."

ENERGY

Building a Bigger Generator

It has long been almost axiomatic in the electric power industry that the larger (in rated power) a generator, the cheaper (per kilowatt) it will be to buy and run. The constraint on size has been the requirement that the system be able to survive the sudden loss of the individual generator; in practice, that usually means that the unit constitute no more than about seven per cent of the system's total generating equipment capacity.

But as power systems grow, that seven per cent becomes a very large number of Mva.—and we are now developing a market for generators so large and difficult to build that the



The armature of the experimental superconducting generator being developed at M.I.T., shown in a late stage of construction. Because the field winding, which will rotate inside the armature, is a superconducting magnet, it can pro-

duce much stronger magnetic fields than are normally possible. Thus there is no need for a heavy iron core; this armature is made entirely of copper, glass, and epoxy.

economies of scale begin to vanish. The size limit for an economical generator using conventional technology, according to Professor Gerald L. Wilson, Director of M.I.T.'s Electric Power Systems Engineering Laboratory, is in the range of 1,000 to 1,500 Mva., or about half the peak power consumption of Manhattan.

Happily, at the same time the electric power researchers began seeking a solution for their problem, researchers in the rapidly developing fields of cryogenics and superconductivity found themselves with what Professor Joseph L. Smith, Jr., head of M.I.T.'s Cryogenic Engineering Laboratory, has said was "in many ways, a solution looking for a problem."

Researchers from the two laboratories pooled their expertise and formulated the scheme of using a superconducting field winding (i.e. rotor) in a generator. A superconductor, they reasoned, can carry a very heavy current with negligible loss and remain superconducting in the presence of a very intense magnetic field. (The project directors have been Professor Herbert Woodson of Electrical Engineering, followed by Professor Smith of Mechanical Engineering. The other participants are Professors Wilson, Charles Kingsley, Jr., and James L. Kirtley, Jr., all of Electrical Engineering, and Professor Philip Thullen of Mechanical Engineering. The sponsor is the Edison Electric Institute.)

The unresolved question was whether or not a winding constructed of superconducting material could operate in a stable manner while rotating at 3,600 r.p.m. To answer the question, the group built a small (40-kva.) machine to test the hypothesis and found that it would indeed work.

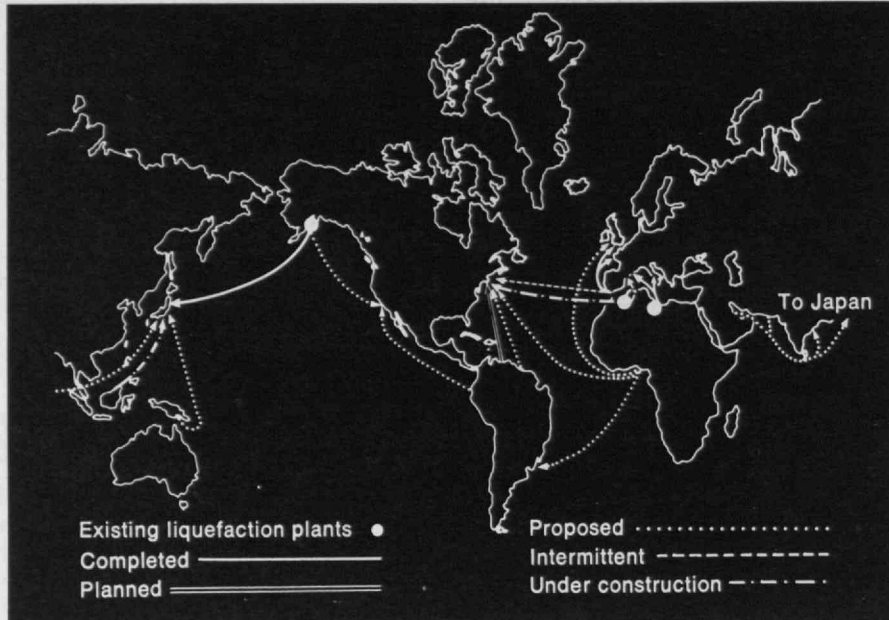
Thus encouraged, the group began

design of a larger (two to three Mva.) model, to be electrically and structurally similar to a large (1000-Mva.) generator of the same type. Scheduled for completion this spring, the new machine includes a system which allows liquid helium to circulate between the rotor and the stationary refrigeration equipment while the machine is in motion, and a unique "electrothermal" shield, fixed to the rotor, which keeps out not only heat but also fluctuations in the magnetic field.

A superconductor quickly loses its superconducting properties if it is exposed to a fluctuating—instead of constant—magnetic field, so the insulating jacket surrounding the rotor includes not only a high-vacuum thermal insulator, but also a layer of copper to keep out variations in the magnetic field.

One of the most important advantages of the superconducting generator is that it can be built without the use of heavy iron cores. When a superconducting field winding is used, much higher field currents—and hence much higher field intensities—become possible. The iron, which is normally used to provide magnetic "circuits" in which a field can be made to stay more completely in the desired path through the machine's windings, is made completely unnecessary by the greatly increased magnetic fields.

In the stator, which is not superconducting, the omission of iron has an added benefit: When the coils are wound around an iron core, each turn must be carefully insulated from the core, which is at ground potential. Thus if the winding is to be compact, output voltage is limited, whereas what is desired is a low current (to minimize the need for cooling) and a high voltage. In an iron-free stator, however,



Existing and projected liquid-natural-gas trade routes. (From a paper by Robert A.

Charpie, President of the Cabot Corporation)

each turn of the windings need be insulated only from its nearest neighbor, which will necessarily be at a minimally different potential. A higher output voltage, and of course a correspondingly lower current, become possible. Whereas the maximum feasible voltage in conventional stators is about 30 kv., the M.I.T. group expects that 300 to 400 kv. might be possible without iron.

But iron has been credited with a second function, that of providing a strong "backbone" to the windings. One of the principal missions of the model under construction will be to demonstrate that a stator built entirely of copper, glass, and epoxy can withstand the necessary stresses.

Members of the superconducting generator group have developed a preliminary design for a 1,000-Mva. superconducting generator. Whereas standard machines of that size would consume about three watts per kva. output in waste heat in the field windings, a superconducting machine would require only 0.04 watt per kva. output in refrigeration power to maintain the superconductor at its required low temperature. The superconducting machine would weigh only a tenth to an eighth as much as its standard counterpart, it would have only about a fourth the overall size, and its output would be at a voltage of about 345 kv., so there would be no need for a costly step-up transformer between the generator and the high-voltage transmis-

sion lines. "The prospects" for such a machine, Professor Wilson thinks "are very exciting."

New England's Power Predicament

New Englanders, whose climate is severe by U.S. standards, use 205 million B.t.u. per capita each year; Americans in general, 320 million. The New England fuel mix contains twice the national proportion of liquid fuel—but there are no oil refineries in New England, and there is ample resistance from conservationists whenever one is suggested. Natural gas, piped in from elsewhere in the U.S., costs three times as much in New England as it does in Texas. Imported liquefied natural gas from North Africa costs even more; nevertheless New England has pioneered this source.

New England's energy picture is peculiar because the area has no indigenous energy sources of any kind, said Manson Benedict, Professor of Nuclear Engineering, opening a meeting of New England executives at M.I.T. late this fall. But he also noted that there may be oil or gas off the coast of Cape Cod—as has recently been discovered off Nova Scotia; and if oil is there it could make as big an economic difference to the region as the North Sea discoveries have made to Britain and her neighbors.

Moreover, whether there is hydrocarbon under it or not, the cold sea of these northern coastal states is a power resource anyway, said Professor Benedict: by lowering the cool end of the thermodynamic cycle it provides the inhabitants of Maine with six per cent more electricity per gallon of fuel than is available to the people of Florida.

Francis M. Staszkesy, Executive Vice-President of Boston Edison Co., described plans of the New England Power Pool, of which all privately owned power suppliers in the region are now members. It is intended to be a self-contained network of mutual back-ups that will fail no more than once in 10 years. But by obstructing new plants, New England's stubborn conservationists, he said, have brought the reliability figure down to 1.1 years.

One of the latter, Allen H. Morgan, Executive Vice-President of the Massachusetts Audubon Society, argued that growth in the rate of resource consumption must stop sooner or later (any form of physical growth, if continued beyond its optimum, becomes fatal), that within a few decades at most the demand for power will reach the point where it can no longer be satisfied, and therefore that we might now begin to consider what the optimum level of power-use might be. "There isn't anybody on my side funnelling research funds into these problems," he pointed out. And there are no agreed goals, either for Cambridge or for the U.S.A.

Not to know where we are trying to go is perhaps usual enough; but M.I.T.'s Morris Adelman, a professor of economics who has paid particular attention to fuel questions, completed the picture by telling the executives that we do not know where we are. The price structure of the fuel industry is so hopelessly distorted that the underlying realities of resource availability are hidden from sight. For example, "all the indirect indicators seem to point to greater long-run scarcity" of crude oil. "Seem to" is used advisedly," he said, "since we really don't know." And—because we're trying to weigh alternatives—"this is a particularly bad time to be stuck without an efficient price system."

Robert A. Charpie, President of the Cabot Corp., was nevertheless able to speak with some confidence about the coming of liquefied natural gas (L.N.G.) to New England. In 10 to 15 years, he said, five to ten per cent of the region's energy will come in this form. He analyzed the economics of liquefying, shipping, and storing natural gas and concluded that base-load gas should become about 25 per cent cheaper in that time. And he showed a map of the world's L.N.G.

trade which made Boston look like the maritime Hub that it used to be. Somebody thought that a giant natural-gas tanker might be something of a fire risk. Mr. Charpie replied that the maximum credible accident—adrift, alight, in a harbor full of ships—was insurable. He did not actually mention the contrast with nuclear power stations in this respect, but Mr. Morgan (“nuclear power looks good if it’s safe”) was for a moment not entirely on his own.

THE MOON

Unravelling the Lunar Layers

The outer shell of the moon is cold and rigid—and differentiated. And this outer crust, made up of two distinct layers of igneous rock, surrounds a mantle of unknown depth, suggesting that there are at least three “coatings” covering whatever comprises the lunar core.

These results, reported in *Science* and at the fall meeting of the American Geophysical Union, are considered the first clear evidence that the moon was once so hot as to be molten. M. Nafi Toksoz, Professor of Geophysics at M.I.T. who spoke for the research team at the A.G.U. meeting, called them “among the most significant scientific findings to result thus far from man’s exploration of the moon.”

In the first 398 days after the Apollo 12 astronauts installed the first successful lunar seismic station, that station recorded signals from 272 natural moonquakes, an average of one event in 1.5 days, and four man-made impacts—those of the Lunar Module ascent stages of Apollo 12 and 14 and the Saturn boosters from Apollo 13 and 14. All but the latter were so weak that even the largest would barely be felt by a human standing at the epicenter.

Two different kinds of seismic events have been identified. One yields records similar to those from artificial impacts on earth; in this category are the four man-made events and some 100 natural events presumed to be meteorite impacts. The other type, occurring chiefly at monthly intervals near the time when the earth and moon are nearest each other, have repetitive characteristics which suggest structural, internal events.

The four man-made impacts produced records which are “utterly different” from seismic recordings obtained on earth. All have “exceedingly” long duration, the reverberations continuing for over four hours. By analyzing these seismic records and comparing them

Relative seismic intensities as recorded by the Apollo 12 seismometer during its first 13 months of operation. Heights of the bars represent two-day sums of the squares of vertical motions (more precisely, of the maximum vertical motion during any one seismic event). The monthly cycle of activity correlates very

with terrestrial data, Dr. Toksoz and his colleagues conclude:

□ The surface of the moon is covered to a depth of one or two km. with a mixture of soil (known as fines), breccias (soil particles welded together by meteor impacts), and broken rocks (shattered by meteor impacts).

□ The crust, below this mixture, has an upper layer of fine-grained igneous rocks (basalt) to a depth of about 25 km.

□ A lower layer of crust, from 25 to 65 km., “seems to be distinctly different from the basaltic lunar rocks sampled from the surface.” It has seismic characteristics similar to those of gabbro, a coarse-grained igneous rock found at the lowest levels of the earth’s crust.

□ Below the 65-km. level comes the mantle, whose thickness is undetermined. Seismic velocities in this material—whatever it is—are higher than those for most terrestrial rocks but are close to those seen in magnesium-rich olivine formations on earth.

The “extensive differentiation of the lunar mantle” which is implied by this model, with two distinctly different crustal layers, “implies that melting or partial melting of the lunar interior was extensive in its early history,” Dr. Toksoz told the I.G.U.

Meanwhile, writing in *Science* (November 12, pp. 687-92), Professors Toksoz and Frank Press (Head of the Department of Earth and Planetary Science at M.I.T.) and seven other colleagues at Columbia, the University of Hawaii, and General Dynamics Corp., report their analysis of the “natural” structural moonquakes recorded by the lunar seismographs. These seem to be from earthquakes at

accurately with the distance between the moon and the earth; 85 per cent of the detected “moonquake” energy comes, each month, within the interval from four days before closest-approach (perigee) to three days after (*Science*, 12 November 1971, pp. 687-692).

only a few discrete lunar sites, probably at considerable depth. The hypothesis is that tidal forces generated by the earth as it most closely approaches the moon add to internal lunar forces to trigger the repetitive events.

Though moonquakes seem to be frequent, the rate of lunar seismic energy release is described as “far below” that of the earth.

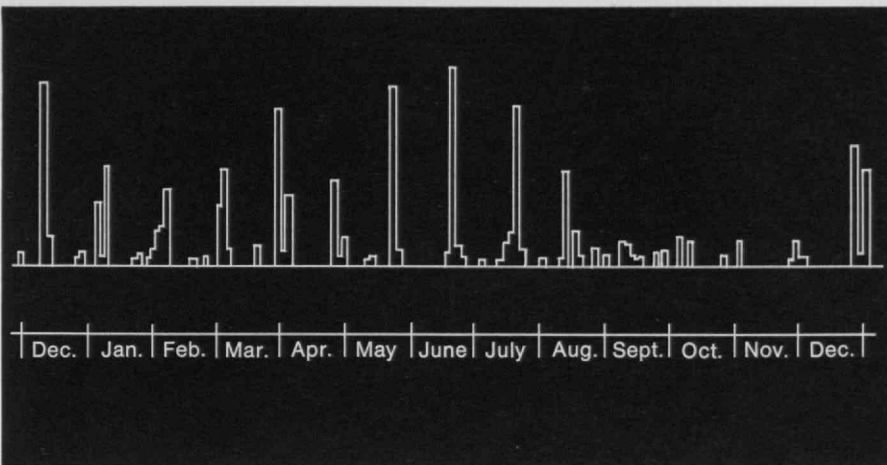
Finally, the geologists report in *Science* a single moonquake recorded shortly after the Apollo 15 seismic station was added to the “network”: it was focussed at a depth of 800 km., deeper than the center of any known earthquake. It implies that the moon is a rigid structure even at this depth, and it is an observation with “profound implications concerning the dynamics of the lunar interior.”

SOCIETY

Technology in History

That technological change affects the way people live is not contested—the proponents of any technical innovation can usually show that it will increase comfort, leisure, safety, or some other agreed good. On the other hand, some popular authorities, such as Alvin Toffler and Marshall McLuhan, have confidently predicted technically-induced social and psychological changes of particularly sweeping and disturbing kinds. But as yet, although there is plenty of guesswork based on common observation, there is little research.

In this connection it has become customary to mention, almost as the “only



game in town," Harvard's Program on Technology and Society. That program, started in 1964 and intended to run for ten years, will publish its final report this spring, according to a terse Harvard announcement. The program's most recent publication is a review of the literature on *Technology and Social History*.

What is immediately striking in this collection of extended abstracts is the dearth of research on the social impacts of specific technologies (of the kind of, for instance, Elting Morison's often-quoted study of the effects of continuous-aim firing techniques on social relations within the Navy). Plainly, the study of "technology and society" is still predominantly in an early stage where "technology" is treated as a single force. The reviewer, historian John H. Weiss, differentiates the main bulk of the literature into two sub-fields: the life of technology itself—that is, the linkages within the community of scientists, engineers, industrialists and other agents of innovation; and the economic effects.

How much is known so far? In an introductory chapter, Weiss notes that "long-run and short-run effects can be almost the opposite of one another. . . . The first century of the Industrial Revolution in England offered increased employment for children, thereby raising the opportunity cost of education and negatively affecting the demand for it. Only after the 1880's does it seem that industrial prosperity resulted directly in greater investment in education." Moreover, although the field of study is technological change as an *agent* of social change, one can go wildly adrift by making reasonable-looking assumptions as to which came first: "Formulations such as 'the typewriter emancipated women by creating a demand for office personnel which offered them "respectable" careers' have entered standard textbooks. . . ." Weiss observes, whereas "S. C. Gilfillan points out that in Japan a class of female office workers grew up who were neither 'liberated' nor employed as typists. American women were in the process of becoming occupationally emancipated at least a generation before the appearance of typewriters."

Clearly, there is work to be done, but it is work of a kind that is difficult even to formulate, and it costs money. The Harvard Project was funded by an I.B.M. grant of \$5 million. In the early 1960's there was much anxiety over the possibility that computers might prove sufficiently effective to create widespread unemployment; hence I.B.M.'s interest in "technology and society." As the years passed this fear proved groundless; but the Harvard team, under Dr. Emmanuel G. Messthene, began to discover what kinds of

research could in fact be done on the social effects of technology. In the past two or three years the Program's staff have felt that they were "beginning to get someplace."

But when, following the original timetable, the Program's progress was reviewed by the university at the end of its sixth year, it was apparently felt that the \$2 million still unspent might be better used as capital for continuing faculty income rather than for three or four more years of research. President Pusey appointed an external (to Harvard) committee, who arrived at this general recommendation; and an internal committee headed by Harvey Brooks and Don K. Price, respectively Dean of Engineering and Dean of the Kennedy School of Government, then specifically proposed the termination of the Program and its replacement by two or three new professorships "in the general field of technology and society." These would probably be in the Kennedy School, Engineering and perhaps Arts and Sciences. Although one cannot, of course, prejudge the selection process, it seems unlikely that these posts will go to Program members.

Columbia University's Institute for the Study of Science in Human Affairs is also being closed down. In an article in *spsng Newsletter* (Vol. 2, No. 9, pp. 4-6; M.I.T. Press) the Director of the Institute, Christopher Wright, attributes this decision to "overriding institutional problems rather than limits of possible knowledge of science in human affairs."

Model Human Life Only with Caution

Although some of the most impressive recent developments in the social sciences have involved mathematical modeling and analysis, not a few social scientists are left with lingering doubts. Just what are the limits of applicability, one must ask, of the "scientific" techniques which have achieved such phenomenal success in the natural sciences?

Gunnar Myrdal, the Swedish economist and sociologist, elaborated the point at a recent lecture at Harvard. "In recent decades," he said, "there has been a strenuous and strained effort by the majority of my economist colleagues to emulate what they conceive of as the methods of the natural scientists by constructing utterly simplified models, often given mathematical dressing. This type of model-building has been rapidly spreading in the other social sciences too, where, in turn, the researchers seek to emulate the economists."

They are motivated, Professor Myrdal said, by a "general understanding, which to us social scientists must be especially disturbing . . . that in our field of study progress is very much slower than in the natural sciences."

Unfortunately, he continued, adoption of the mathematical methods of analysis and presentation used in the natural sciences does not necessarily make the social sciences more scientific. Quantitative analysis is worthless when there are no valid quantities to analyze—and the stress is on that "valid." If the "institutional" type of social scientist has fewer figures to present than does his "quantitative" colleague, it is not because he neglects to obtain numerical measures but because "he is more critical in ascertaining them."

"I have certainly, *per se*, no criticism to raise against models," Professor Myrdal cautioned. "All scientific research must be generalizing and thus simplifying," and quantitative analysis often yields very useful results in limited cases. But it is very easy to be led astray by the figures: the factors to be included have to be chosen "according to the criterion of relevance."

What the model-builders tend to ignore, Professor Myrdal believes, "is that the problems we are dealing with are truly much more difficult to master than those in the natural sciences."

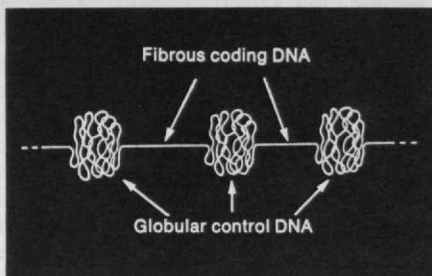
"The study of social facts and relationships really must concern much more complex and fluid matters than those represented by parameters and variables in highly abstract models, where behavior, accounted for only in terms of aggregates and averages, is left unexplained. . . . We are dealing with the behavior of human beings who have a soul, and who are influenced by their living conditions in the widest sense of the word."

LIFE SCIENCES

How Chromosomes Got Their Stripes

Francis Crick and James Watson described the double helical shape of DNA 18 years ago, and thus solved an essential problem in molecular biology. DNA is the material in which the body's genetic information is stored, for use as "blueprints" when new cells or new organisms are to be made. Now Dr. Crick may have solved another essential problem in cell biology, this time with his theory of how DNA is arranged along the chromosome, and how the arrangement functions in this process of manufacture (i.e., in the making of specific proteins).

Chromosomes, those that have been examined under a microscope, show



This "extremely schematic" diagram was provided by Dr. Crick to demonstrate the band (convoluted) and interband (straight) regions of the DNA molecule as he proposes it winds itself along a chromosome. The straight regions, he suggests, contain the actual code for making a protein, and the twisted ones provide the controls over that process. (Diagram: *Nature*)

alternating fat and thin regions called bands and interbands. Present models assume that all the DNA in the chromosome is in the form of one long molecule (the chromosome also has molecules of other proteins whose function is unknown). The making of a protein requires that the DNA blueprint be read and copied, and that there should be some means of starting and stopping the operation, limiting it to the relevant excerpt from the DNA "tape." Dr. Crick suggests (in *Nature*, 234:25-7) that the interband contains the designs for each protein, and the band provides the controls. (*Technology Review* for December, 1970, p. 53-4, reports some initial work on gene controls.)

Manufacture is initiated by the arrival of a "messenger" (such as an enzyme or hormone molecule) to order the making of a particular protein. This messenger must find a receptor site on the proper control gene in order to activate it. In those protein molecules whose structure we have defined clearly enough, we see that this site is usually a shallow groove or cavity in the molecule. DNA's double helix is formed around proteins called deoxynucleoside triphosphates, which make a backbone like a twisting ladder. Attached to the triphosphates at each end of the rungs of the ladder is one of four "bases"—guanine, adenine, cytosine, and thymine—the letters of the DNA alphabet, in which the genetic information is encoded. These bases also compose the active sites that must receive the messengers, and the sites lie within the helix.

Dr. Crick believes the DNA in the band region is particularly convoluted—which is what makes the band thick and globular—so as to make these active sites more accessible. "When very large numbers of different sequences need to be recognized (which implies

that the sequence must not be too short)," he writes, "it will pay to unwind the double helix." This is the center of his theory—that the complementary strands of DNA separate from each other and coil and twist by themselves along much of the molecule in any given band. He suggests that the strands form into very specific patterns, and that the histones (a group of proteins also found in the chromosome) may help to separate the strands and then hold the patterns together.

The band region contains all but a few per cent of the DNA in a chromosome, Dr. Crick proposes. Even so, he adds, the interband region still contains enough DNA to code for an "average" protein of a molecular weight of 30,000 to 40,000 (at least in *Drosophila*, one of his sources of chromosomes). He theorizes that each interband directs the making of a specific protein, and that it is controlled by the band adjacent to it. The band is so large in order to give plenty of material for precise qualitative and quantitative control.

The model, in its simplest form, suggests that the number of different proteins normally produced by higher organisms may not be much more than a few thousand (for *Drosophila*) or a few tens of thousands (for man, based on our present knowledge of the size and shape of human and other chromosomes). And the model does, he concludes, fit "a very large amount of experimental data obtained using very different techniques . . . [including] rough estimates from genetic data of the number of genes in *Drosophila* and man [and] the correlation between the number of bands plus interbands and the number of effective genetic areas."

Nature comments that "It will obviously be difficult to gather evidence either to support or to refute Dr. Crick's model, but his prediction that globular regions contain single-stranded DNA provides the most obvious handle. . . ."

Dietary Engineering

The strongest preoccupation of "pop" culture today is with our feeding habits, yet much of what is said has about the same consistency as the natural gruel which young dietary revisionists serve up as salvation. In a field which is dominated by well-meaning but unscientific (or anti-scientific) practitioners, those who should know what they are talking about have remained stubbornly silent.

As a result, most people have heard nothing scientific on the subject of nutrition since their fourth-grade health classes—and those were back in the days when we thought DDT was some-

thing that killed insects and mercury was found only in thermometers.

The reason the scientific community has not stepped in to clear the air, Dr. George G. Graham, Associate Professor of Pediatrics and Professor of Human Nutrition at Johns Hopkins, told the American Chemical Society this fall, is that surprisingly little is known about human nutrition. For example it is widely assumed, Professor Graham said, that nutritional deficiencies early in life cause mental deficiencies; in fact, nutritional deficiency is only one of a number of explanations which have been proposed. Yet we find the nutritional explanation of the deficiencies of children from poor families a particularly attractive one—possibly because of its simplicity: "Why, if we feed these poor people enough, they may become docile, highly productive, and perhaps even turn white!"

We propagate the belief, "despite the excellent evidence to the contrary, that in nutrition 'more is better.'" In fact, Professor Graham reminds us, overnutrition has been blamed as a leading cause of obesity, diabetes, degenerative vascular disease, and the aging process itself.

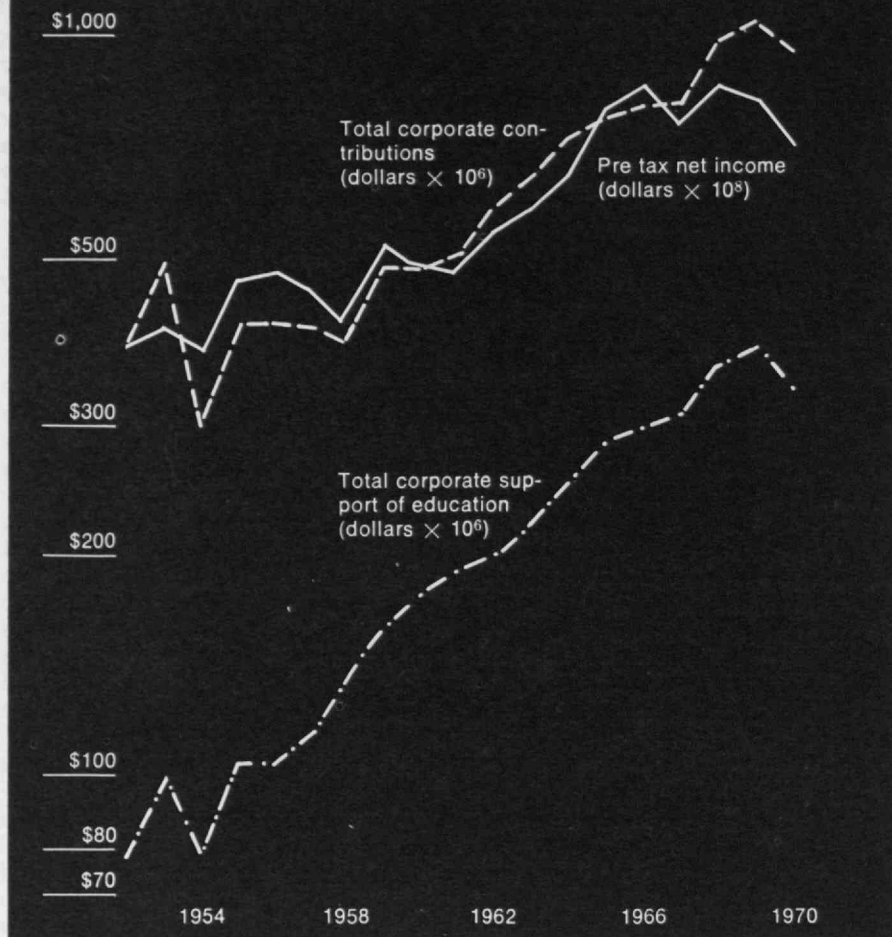
"More recently it has been demonstrated that eating patterns of early life may irreversibly determine a person's eventual fate, laying the ground for subsequent obesity and the aging process." In lamenting the dietary deprivations of the unfortunate, we tend to forget "the well-founded suggestion that perhaps two-thirds of our people should go to bed hungry every night."

What is most needed, Professor Graham tells us, is data on what are the optimum intakes of all the nutrients, on how we can rectify certain physiological problems through dietary control, and on how hormones regulate the utilization of nutrients.

But, "beyond a doubt, the single, most important goal of human nutrition should be the definition of the optimum rate of growth, that which results in the 'greatest useful longevity,' . . ." and the rates of nutrient intakes associated with it.

"The foregoing statements may sound as if I am proposing some form of computerized formula-feeding for all human beings, and in a way, that is what I am doing," Professor Graham posited. The benefits would extend beyond better health to include far-reaching economies in food production and preparation and even construction costs. (There would no longer be any need for kitchens.) "Already over half of the meals consumed in this country today are prepared and fully one-third are consumed outside the home."

Mass feeding by formula, Professor Graham points out, would "do nothing more than conform to this trend."



Both U.S. corporations' educational support and total corporate philanthropy reached new highs as a proportion of company net income before taxes in 1970, according to the Council on Financial Aid to Education. Indeed, says C.F.A.E., since 1967 there has been "a significant upward shift" in philanthropy in relation to corporate profits. But education's share of this largesse

has been slipping, from 38 per cent in 1967 to 34.3 per cent in 1970. Why? Partly, at least, because business now has a different sense of social responsibility, and partly because it feels an alienation from the campus, C.F.A.E. speculates. Whatever the cause, these developments taken together may mark "the beginning of a new era in corporate philanthropy."

EDUCATION

Philanthropy Trend Interrupted

For 12 consecutive years of the past 18 since the Council for Financial Aid to Education began its annual surveys of corporate giving to education, the figures have gone up. But the ninth biennial survey, for 1970, reverses the trend: total giving to education by U.S. business dropped to \$340 million in 1970, compared to \$355 million in 1968 and an estimated \$375 million in 1969. The 1970 decrease is thus over 9 per cent.

But pre-tax net income of corporations fell much more, and in 1970 companies gave a larger proportion of their earnings to education—0.45 per cent of

total pre-tax net income—than ever before. General corporate philanthropy increased even faster. Three industries reporting higher net income before taxes made "a very sharp increase" in their contributions to education, according to C.F.A.E.: merchandising, petroleum, and telecommunications. Four industries reported declining profits before taxes but still made "sizeable" increases in educational support: insurance; machinery; stone, clay and glass products; and textiles.

Indeed, the textile industry led all others in educational support as a share of pre-tax net income in 1970, closely followed by: primary metals; stone, clay and glass; and transportation equipment industries. Telecommunications were at the bottom of the list of givers, just under mining and utilities.

Open University: Teach Yourself

By 1980, says Edward C. Moore, Chancellor of the Massachusetts Board of Higher Education, the demand for college education in Massachusetts will double—from 260,000 in 1971 to 524,000 students. Fearing that no combination of public and private institutions of conventional form could so quickly extend higher education to such large numbers of young people—and then later as easily contract when a lower birth rate might reduce demand once more—Dr. Moore early in 1971 asked Jerrold R. Zacharias and his colleagues in M.I.T.'s Education Research Center to study an "open university" alternative.

They responded with a plan to supplement colleges and universities operating in the conventional lecture-classroom-laboratory-quiz mode with a university-level educational institution operating without a campus. It would send teaching materials, both conventional and unconventional, to its students for use at their own pace in their homes, conduct seminars, and qualify foremen and supervisors in various industries as instructors, able to adapt work experience related to the students' career interests as educational experience acceptable for academic credit. Indeed, such on-the-job learning would be expected of most students—at least on a half-time basis.

The plans for an "open university" which Professor Zacharias and his colleagues submitted to Dr. Moore late this fall made these proposals:

□ While it sought to keep pace with the numbers of young people seeking college experience, the "open university" should also help broaden access to college training and degrees. Even with recent rapid expansion of state-supported higher education in Massachusetts, few of its students come from low-income and minority families; and there are essentially no opportunities for adults to translate their job experience into academic credits toward degrees.

□ The "open university" would be oriented around learning—not teaching or basic research. The emphasis would be on students working at their own pace to qualify themselves, not on organized classroom or laboratory programs.

□ The "open university" would have costs per student far lower than any now known in Massachusetts, made possible by "an integrated, multi-media approach" including conventional correspondence courses as well as radio and television, packaged kits, tapes, films, and computer-assisted instruction.

□ Each student would be guided through the "open university" by a tutor and a mentor. The tutor—perhaps a student who has already mastered a course—would provide academic help, teach seminars, and give examinations. The mentor—with help from the tutor—would work with the student to plan his long-range academic program, including jobs as well as courses.

Can such an institution maintain acceptable academic quality? When he finished a period of study, an "open university" student would end up with two kinds of credentials—a report by his mentor and a portfolio of experiences and accomplishments which the student would assemble to record his "open university" work and his relevant non-academic experience. When a student felt ready for an academic degree, he would take his reports and his portfolio to a Degree Committee for evaluation.

Needing few classrooms, the university would operate with an administrative headquarters and several neighborhood or regional meeting places or "study centers." Dr. Zacharias and his committee said the Boston Architectural Center—providing courses and training conferences for students and practicing professionals in a wide variety of architectural fields—may be the nearest contemporary prototype for the activities of such a center.

Members of the Education Research Center study group propose that "open university" costs per student per year for mentor, tutor, evaluation, and adjunct faculty might be \$680. Though they declined to estimate the costs of course development, they insisted that even if these added "a substantial increment" to the cost-per-student estimate, the "open university" would "offer higher education at substantially less cost than other colleges.

In a special parallel study, W. Ted Martin, Professor of Mathematics at M.I.T., reviewed experience with the Open University which began operation throughout the British Isles in January, 1971. After about a year of planning, the British Open University enrolled 25,000 students, compared with a total entering class in all conventional universities in the United Kingdom of about 70,000 in 1970.

Dr. Zacharias and his colleagues believe that an "open university" for Massachusetts should be started in September, 1972, with training programs in social welfare (day care, case work, labor relations, and drug addiction), pre- and para-law (legal aid, prison work, and police and legislative aid), and pre- and para-medicine and health (training nurses, medical technicians and managers, and physicians' aides).

The "open university" would be different from present universities less because of its form than because of its students, Professor Zacharias told an M.I.T. seminar this fall discussing the E.R.C. report. Conventional universities control their student bodies through selective admissions, so that all students who come can be expected to accept and use what the university offers.

But an "open university" would accept all applicants, and it must be prepared to accommodate varied numbers of students with many different—and changing—interests. This is among the requirements which led the E.R.C. study group to suggest that most "open university" teaching be in the hands of the students themselves—as students and as tutors for other students.

A very different rationale for the "open university" came from Carl F. J. Overhage, Professor of Engineering who is Director of M.I.T.'s Project Intrex. He believes it could make a significant contribution to the training and upgrading of technicians, for whom conventional engineering education is denied. It would tackle the problem of "preparing people for the realities of the working world," he told a seminar on the "open university" report this fall. Without this kind of opportunity for its workers, Professor Overhage said, the U.S. may end up making paper umbrellas while the Japanese build all the world's electronics and automobiles.

Needed: Prevision

Are today's college students more perceptive of the future than their teachers? Do students really know—as much as they think they do—about where the action really will be when they're ready to join it? Or do university administrations know better?

The fact is that when either group confronts the other on this problem, it's simply a case of the pot and the kettle calling each other black.

Robert C. Wood, President of the University of Massachusetts, speaking at a conference for New England executives at M.I.T. this fall, accused most universities of being much more sensitive to what parents want and to "the self-serving interests of academic departments" than to any long-range view of national needs and resources.

Students have no better crystal ball. President Wood also pointed to the kind of "faddish" popularity of some schools among young people, popularity which has no basis in any reasonable evaluation of academic excellence. And students fail to appreciate that there is a seven-year time delay between their career decisions and entry into their professions.



Photo by Louise Bucknell

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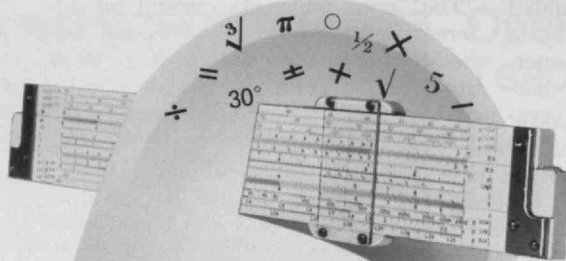
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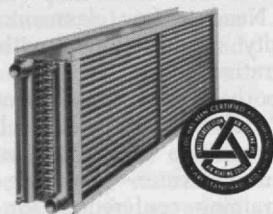
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Puzzle Corner

Allan J. Gottlieb

Congratulations!

I have another dedication to make, this time on a pleasant note. As I am getting married, this issue of "Puzzle Corner" is hereby dedicated to my fiancée, Alice; no longer can she be referred to as "the girlfriend." I'm not exactly sure what this will do to "Puzzle Corner"—or to other aspects of my life; and any suggestions will be appreciated.

Some free advice: when any readers are ever within 500 miles of San Diego, go see the zoo—it's fantastic. Finally, if anyone has suggestions to make concerning problem selection, don't be bashful; I shall be grateful. Write to me—and send problems and solutions—at the Department of Mathematics, University of California, Santa Cruz, Calif., 95060.

Problems

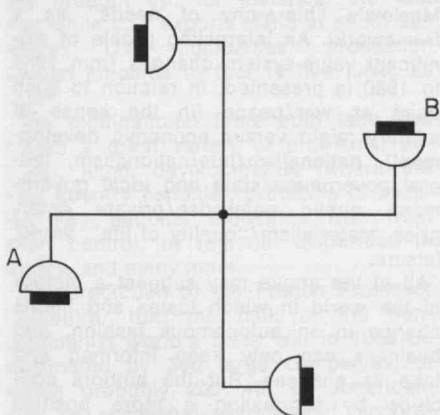
First is a chess problem from Philip D. Bell:

61 Set up chess pieces as though to start a game. White *must*, in proper sequence, make the following four moves: 1. P—KB3; 2. K—B2; 3. K—N3; and 4. K—R4. What are the four legal moves to be made by Black after which White is checkmated?

P. Markstein sends the following geometry problem:

62 Given line segments of length h_c , t_c , and m_c construct a triangle such that the altitude has length h_c , the angle bisector has length t_c , and the median has length m_c when these three lines emanate from the same angle.

Here is a new perpetual motion machine to work on—from Morris Markovitz:



63 This "ferris wheel" is constructed under atmospheric pressure. Metal cups are attached to each arm, and a pliable membrane seals the top of each cup.

Glued to the center of each membrane is a weight. The "ferris wheel" is now submerged in water. The weight at cup A stretches the membrane, increasing the cup's volume. The weight at cup B compresses the cup's volume. Thus, cup A is more buoyant and the "wheel" rotates in a clockwise direction forever.

A number-theory teaser from Frank Rubin:
64 Consider the infinitely nested square root

$$\sqrt{a_1 + \sqrt{a_2 + \sqrt{a_3 + \dots}}}$$

Prove that the nest converges when $a_n = n$. Does it converge when $a_n = n^2$? $n!$? How about when $a_n = (n!)^{n^2}$?

Please recall problem 29 from last year (April, 1971): "In how many different ways can eight numbers be rearranged such that no number occupies its original position? Write out all the possibilities. Find the answer for n numbers in general." John Bobbitt asks the following (apparently hard) question about it:

65 What fraction of the arrangements possible meet the criteria of having every digit change its position? In other words, does the sequence $a_n = k_n/n!$ converge?

Speed Department

William Glassmire sends in the following, which he says has "some historical significance":

1 It is well known that an 8×8 checkerboard with diagonally opposite corner squares removed cannot be covered with 31 dominoes (each of which covers two squares of the board). Suppose that two squares are removed arbitrarily, subject only to the restriction that one is black and the other is white. Is it always possible to then cover the board with 31 dominoes?

A. Porter wants you to:

2 Find the relationship between the sides of a rectangle which guarantees that doubling the short side gives a new rectangle having the same relationship.

Solutions

41 Given these hands, against South's contract of six diamonds, West leads ♥Q:

♠ A K 5	♠ J 9 8 2
♥ 10 7 4 2	♥ 9 8 3
♦ Q J 7 6	♦ 8
♣ J 10	♣ K Q 5 3 2
♠ 10 4	♠ Q 7 6 3
♥ Q J 6 5	♥ A K
♦ 10 9 4 2	♦ A K 5 3
♣ 9 7 6	♣ A 8 4

How does South manage to bring home a small slam?

The following is from Jeffrey A. Miller: Declarer must get two heart ruffs in his hand and establish a fifth black trick by squeezing East, in addition to taking his two good hearts and three trump tricks (he must yield one trump trick to West in order to get his two ruffs). He must also use the diamond suit to enter the dummy once. The order of play: 1. Declarer wins

♥A. 2. Declarer wins ♦A. 3. Declarer wins ♥K. 4. Declarer leads low trump to Dummy, and if West ducks Dummy inserts ♦7 (this would allow declarer to take all 13 tricks); assuming West goes with ♦10, Dummy will win with ♦J; East pitches low club. 5. Dummy leads small heart. 6. Declarer enters Dummy by leading small spade to ♠K. 7. Declarer ruffs last heart high in hand (East discards low club). 8. Since Declarer is now out of trumps, he must enter the Dummy with a low spade to Dummy's ♠A. 9. Dummy leads high ♦Q; East pitches a low club, Declarer likewise discards a low club, and West follows with ♦4. 10. Now Dummy plays its last trump; East is squeezed in the black suits; if he unguards is ♠J, Declarer will discard a low club; if he unguards his ♣K Declarer will discard a low spade; West will win the trick with his high trump and must return a club. 11. Declarer wins ♣A. 12 and 13. Declarer wins his two good black tricks (either ♠Q and ♠7 or a club to Dummy's ♣10 and ♣Q).

Also solved by Richard Bator, Andrew Fillat, Winslow H. Hartford, George Heyman, Stanley A. Horowitz, Elmer C. Ingraham, Michael A. Kay, Mrs. Martin S. Lindenberg, John W. Meader, Joseph Orenstein, R. Robinson Rowe, Patrick J. Sullivan, Smith D. Turner, Dr. Stephen S. Washburne, and George J. Wynne.

42 What is the smallest number (N) of n digits ($n > 1$) which, if you remove the digit (d) from the units place and relocate it in front of the n 's place, exactly multiplies the number N by that digit d ?

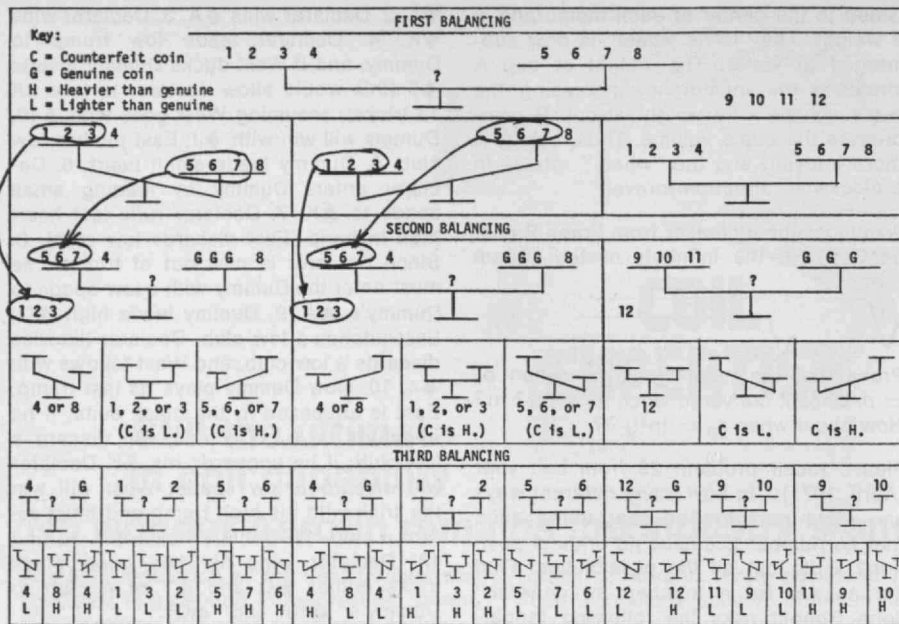
R. Robinson Rowe notes that a "trivial" answer, unintended by the proposer, is $N = 11$. If instead of specifying $n > 1$ he required $d > 1$, then the answer is $N = 102564$. The complete set for all d is:

d	n	N
1	1	1
2	18	105, 263, 157, 894, 736, 842
3	28	1, 034, 482, 758, 620, 689, 655, 172, 413, 793
4	6	102, 564
5	42	102, 040, 816, 326, 530, 612, 244, 897, 959, 183, 673, 469, 387, 755
6	58	1, 016, 949, 152, 542, 372, 881, 355, 932, 203, 389, 830, 508, 474, 576, 271, 186, 440, 677, 966
7	22	1, 014, 492, 753, 623, 188, 405, 797
8	13	1, 012, 658, 227, 848
9	44	10, 112, 359, 550, 561, 797, 752, 808, 988, 764, 044, 943, 820, 224, 719

43 A "most interesting" number is 012345679 (8 is missing). In the range 0 to 81, multiplying by any multiple of 9 gives an answer with all digits the same; multiplying by any other multiple of 3 gives an answer containing three different digits; multiplying by any other number gives an answer containing nine different digits (none repeated); and the missing digit is cyclical with increasing multiplier except that 0, 3, 6, and 9 are never missing. Why?

Raymond Gaillard submitted this solution:

$$\begin{aligned} x &\equiv 16 \pmod{39}; x \equiv 27 \pmod{56}; \\ 27 + 56t &\equiv 16 \pmod{39}; \\ 56t &\equiv -11 \pmod{39} \equiv 28 \pmod{39}; \\ 2t &\equiv 1 \pmod{39} \text{ or } 2t \equiv 1 + 39u. \\ x &\equiv 27 + 2(28)t \pmod{39}; \\ x &\equiv 27 + 28(1 + 39u); \\ x &\equiv 55 + 28 \cdot 39u \equiv 55 + 1092u. \end{aligned}$$



For $u = 1$ this becomes
 $x \equiv 1147$.

So $x \equiv 1147 \pmod{39 \cdot 56}$ satisfies the condition; i.e., $1147 \equiv 27 \pmod{56}$ and $1147 \equiv 16 \pmod{39}$.

Also solved by R. Robinson Rowe.

44 Find the set of angles x and y for which $\sin(x + y) = \sin x + \sin y$; and prove that your set is exhaustive.

I like John E. Prussing's solution; do you? He writes: Use the identity $\sin x + \sin y = 2 \sin \frac{1}{2}(x + y) \cos \frac{1}{2}(x - y)$, and define

$w = \frac{1}{2}(x + y)$ and $z = \frac{1}{2}(x - y)$. Then the equation to be solved is simply $2 \sin w \cos z = \sin 2w$.

Subtracting from this the familiar identity, $2 \sin w \cos w = \sin 2w$, one obtains the equation $\sin w(\cos z - \cos w) = 0$.

The solutions to this are
 (i) $\sin w = 0$ and (ii) $\cos z = \cos w$.

The general solution to (i) is

$w = k\pi$, implying $x + y = 2k\pi$.

The general solution to (ii) is obtained by using the identity for the cosine of a sum to yield

$\cos \frac{1}{2}x \cos \frac{1}{2}y + \sin \frac{1}{2}x \sin \frac{1}{2}y = \cos \frac{1}{2}x \cos \frac{1}{2}y - \sin \frac{1}{2}x \sin \frac{1}{2}y$, which yields

$2 \sin \frac{1}{2}x \sin \frac{1}{2}y = 0$.

The general solutions to this are

$x = 2k\pi$, y arbitrary, and

$y = 2k\pi$, x arbitrary.

Also solved by Harold Donnelly, R. Robinson Rowe, and Victor W. Sauer.

45 You are given a stack of 12 coins, which appear identical to one another, and are told that one is counterfeit and can be distinguished only by its weight, which is not the same as the genuine coins. Unfortunately, you do not know whether the counterfeit coin weighs more or less than the genuine ones. Using only a balance, how do you find the counterfeit in a minimum number of balancing operations?

Apparently there was some confusion about this. A balancing operation involves simply one balancing—not comparing one

fixed group to each of several other groups. Benjamin Whang sent me the above "pictorial" solution, noting that the problem as stated does not require to determine whether the counterfeit is heavier or lighter; it only requires to *find* the counterfeit. He notes that the middle section of three in the third balancing is not really necessary, since it can be considered a mirror image of the left section.

This problem was popular; solutions also came from Captain P. O. Chapman, Carl L. Estes, II, Bruce Fauman, Raymond Gaillard, Carl J. Greever, Maurice A. Hoffman, Stanley A. Horowitz, Elmer C. Ingraham, W. J. Hart, Lowell Kolb, Hubert duB. Lewis, Mrs. Martin S. Lindenberg, R. Robinson Rowe, Christopher Scholz, John R. Selin, W. H. Stephenson, Jr., Dr. Stephen Washburne, George J. Wynne, and the "team" of Ronald G. McKeown, Raul F. Pupo, William P. Quinn, and Thomas W. Schwegel.

Better Late Than Never

Raymond Gaillard has submitted a solution to problem 39.

Books

Leopold R. Michel
 Visiting Lecturer, School of Management,
 Boston College

During the 1970's and 1980's, long-range planning—particularly that of the larger corporations—will be increasingly concerned with two kinds of change: changes in the business environment due to social and political causes, and the development of the multinational firm. These are the general themes of two books upon which this reviewer has been asked to comment.

The first is a synthesis from a General Electric study concerned with the de-

veloping social and political trends, and aims at the integration of these trends into business plans. The second book stems from work done at Salford University (England) and provides a good overview of the history, current state and possible future of multinational companies, and discusses their political and social impacts. The authors of both books have supplemented the findings of their studies with information gained through interviews with educators, businessmen and government representatives, as well as information from the available literature.

Developing trends affecting the business environment stemming from social changes were interpreted in the General Electric study as the interaction of eight significant forces:

- ☐ Increasing affluence
- ☐ Economic stabilization
- ☐ The rising tide of education
- ☐ Changing attitudes toward work and leisure
- ☐ The growing interdependence of institutions
- ☐ The emergence of the "post-industrial" society
- ☐ Increasing pluralism and individualism
- ☐ The urban/minority problem

Institutional changes—in government, the labor force, business, unions, and educational institutions—are segregated

The Business Environment of the Seventies

Earl B. Dunckel, William K. Reed,
 Ian H. Wilson
 McGraw-Hill Book Company, 1970,
 129 pp., \$15.

Invisible Empires

Louis Turner
 Harcourt Brace Jovanovich, Inc., 1971,
 228 pp., \$6.95

off into a chapter of their own. Also considered separately are the impacts of changing value systems—changes in attitudes towards work and leisure, emphasis on "quality of life," rejection of authoritarianism and dogmatism, emphasis on pluralism and individualism. Consequences of student revolts are discussed, with an anticipation of probable youth-related changes in values (utilizing Maslow's "hierarchy of needs" as a framework). An interesting profile of significant value-system changes from 1969 to 1980 is presented, in relation to such pairs as war/peace (in the sense of military might versus economic development), nationalism/internationalism, federal government/state and local government, public enterprise/private enterprise, materialism/"quality of life", work/leisure.

All of the above may suggest a picture of the world in which tastes and habits change in an autonomous fashion, and business can only keep informed and take its chances. But the authors conclude by suggesting a more positive role—active, rather than reactive. Business should not regard itself merely as self-contained or self-regulating, but be willing to work in national and community coalitions.

A Global Perspective

While Louis Turner claims to have written *Invisible Empires* for the knowledgeable layman who wants to know about world problems created by a new kind of firm, it offers information, discussion and analysis of value to the business executive and long-range planner. The invisible empires are multinational companies, defined as those which have several directly controlled operations in different countries and which tend towards global operation.

The introductory chapters cover the history and present state of the multinational business. The dollar value of U.S. direct involvement abroad puts the subject in perspective: Canada—\$18 billion; United Kingdom—\$6 billion; West Germany—\$3.5 billion; Australia—\$2.4 billion; France—\$2 billion; Italy—\$1.2 billion; Netherlands—\$900 million. In another chapter some of the giant multinationals' power is depicted by matching their sales against the gross national products of single nations. For example, the annual sales of General Motors, \$20 billion, matches Switzerland or Denmark's G.N.P.; Ford's \$11 billion sales is that of Austria or Turkey; General Electric's \$7.7 billion is that of Norway or Greece.

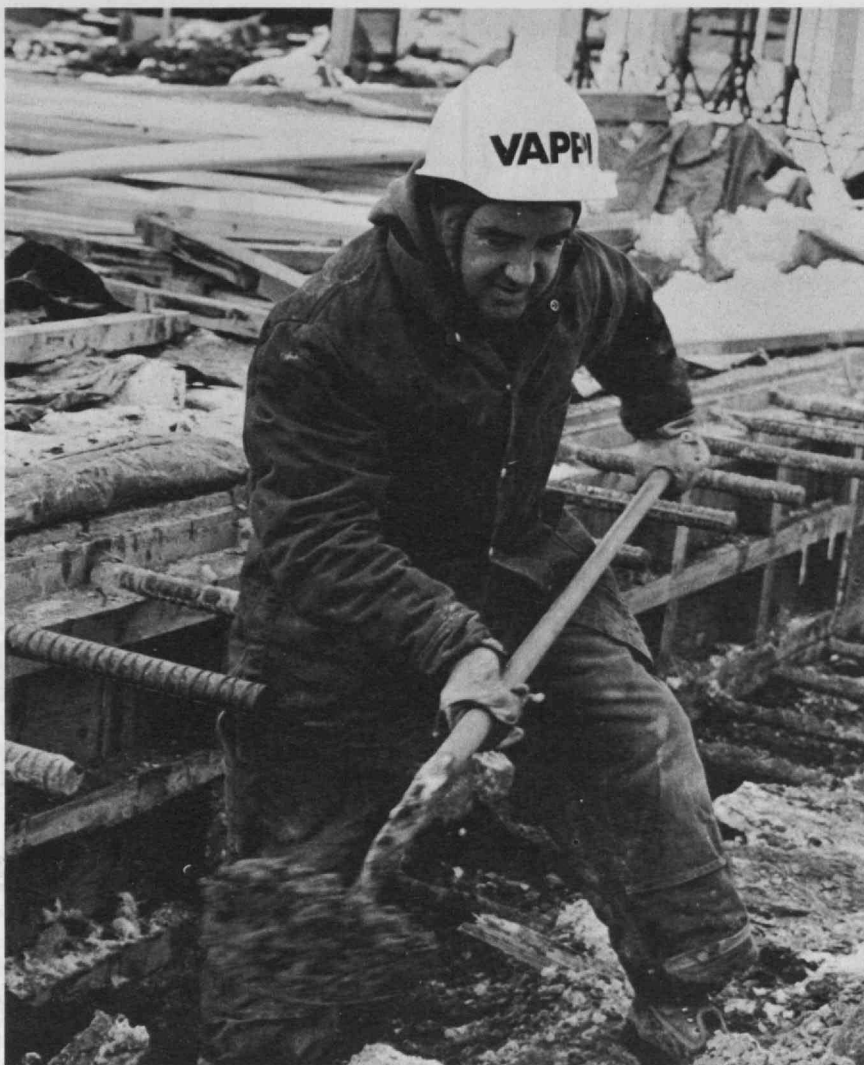
The multinational firms' sales have not, however, grown quite as fast as the G.N.P.'s of the nations they are compared with. Nevertheless, General Motors, Ford, and Chrysler control 30 per cent of the European car market, U.S. oil firms 30 per cent of the fuel market in the non-communist world; of the 26 separate laboratories run by U.S. oil companies, seven are in Europe. I.B.M.'s World Trade division operates in over 100 countries through over 300 sales offices. Of course, not all multinational firms are U.S.-controlled. The book covers some of the others, but seems rather weak on statistics on multinational firms of other nations.

While the outlines of the multinationals provide an interesting background, the thought-provoking analyses are contained in chapters with titles like "What do governments stand to gain or lose?", "The financial implications", "The union response," "The less-developed world."

The balance of payment implications are brought up: for instance, the fact that while U.S. exports stand at about \$25 billion, U.S. companies' production abroad amounts to four to five times as much.

The multinational firms both face and create a great variety of problems: political, legal, developmental (where the host country benefits), problems of keeping key national industries free from alien control, of regional disparities in wages, and many more.

The prediction of the French Professor Perlmutter that the bulk of the non-communist world's trade will in 1988 be dominated by 300 large companies, of which probably 200 will be American, may be somewhat exaggerated, according to Turner. In spite of the thorny problems his book surveys, he believes that the multinational company is an overwhelming force for material progress in the world.



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Institute Review

Undergraduate Financial Aid: The \$10 Million Gap

The crisis in aid for graduate education (see *Technology Review* for January, p. 77) is mirrored on the undergraduate side: The M.I.T. undergraduate's academic budget—the figure considered average by the Financial Aid Office—went from \$4,500 in 1970-71 to \$4,900 this year, and it will be up to \$5,300 next year (figures include tuition, fees, and living expenses, but exclude transportation expenses). As this figure rises, M.I.T.'s resources simply cannot keep pace, says Jack H. Frailey, '44, Director of Financial Aid.

Indeed, he fears that the Institute's financial aid program may now have become weak enough to affect the percentage of students admitted who choose to come here—and to some extent, their quality.

The other schools with which M.I.T. competes for students have the same problem, Mr. Frailey admits, and their cost figures are about the same. All are losing out to the public universities, where tuition is much lower and the family's burden that much lighter.

For the future, M.I.T. is, like the other schools in the same situation, "to some extent marking time, with the feeling that the only substantial help is going to come from Uncle Sam. . . . Features of some of the measures now under consideration in the federal government could be helpful to us," Mr. Frailey believes, but there are a great number of impediments standing between any of the proposals and their ultimate implementation.

Most of the past federal and state programs offering scholarship assistance to higher education have been of little help to M.I.T. because they have been aimed primarily at helping the very poor—a group which includes but a small minority of students here. Government-sponsored loan programs have helped more because of their wider availability (most of this year's student loan money came from the government), but some members of Congress, encouraged by the present administration, would restrict these programs as well to the very poor.

On the more positive side, Mr. Frailey cites the recent "recognition by the [M.I.T.] administration and the Corporation Development Committee that financial aid should be a major focus of

M.I.T.'s fund-raising efforts." He expects to need about \$10 million over the next five years to bring his resources up to need—"and at least half of that should be in scholarship money to distribute to students, not to loan or invest."

For the second year in 1971-72, the Financial Aid Office has used the "equity program" in an attempt to equalize the amount of debt which students carry at graduation: the first ingredient in every annual aid package is self-help (*i.e.* the first \$600 of need must be met by taking a job, and the next \$1,000 is met with loans), and only those who need more than \$1,600 get scholarships.

The job requirement, a consequence of the shortfall of M.I.T.'s financial aid resources, is new—and it is not always easily met. In today's job market some students have "serious problems," reports Daniel T. Langdale, Director of Student Employment. "Most of those who are genuinely interested in working end up with some sort of job, but in many cases the only work available is menial."

Fully 2,200 students, by Mr. Langdale's guess, work at some time or another during the school year. Of those, about 1,400 hold regular part-time jobs, and 1,200 of them are on campus. About 500 are employed in the Housing and Dining Service and Libraries, and 500 more work in laboratories on various sponsored research assignments. Although most students with financial need are expected to work during the school year, they are not given priority for campus employment. M.I.T. has chosen not to give favoritism in what it believes is "part of the fabric of student life."

The Financial Aid Office now allows students who cannot find suitable employment to borrow enough extra money to make up the difference—but as the aid squeeze increases, that policy may end.

What about deferred payment plans such as that recently adopted by Yale University? "No one outside Yale University is watching the results of that program as closely as we are," Mr. Frailey said. And the search is also on for other, more acceptable alternatives. But when the Ford Foundation recently surveyed student attitudes at various schools, most respondents said they prefer traditional repayment plans; at M.I.T., in particular, the students interviewed followed the trend three-to-one.

Dispelling the Doom

"Crisis, my eye!

"Those who yell 'crisis' today have not lived long enough—or refuse to read history," Dr. Vannevar Bush told the audience at this year's Christmas convocation. His message for the holiday season: "Nature is still beautiful, men are mostly kind, life is worth living. Go out, then into the world with the Christmas spirit!"

"I tell you this today because we live in an atmosphere of doom. This doom of ours is a disease—it is absurd, it is diminishing, and it needs to be completely removed and replaced with an atmosphere of sanity."

If you want to see a real crisis, he said, look at the 1920's and 1930's—the folly which ended in the great depression. Significantly, he said, "it was not the loss of money . . . it was the loss of the public spirit that caused the depression."

The way to banish the feelings of doubt and doom, Dr. Bush said, is simply to look at both sides of every important question. On one hand, we should recognize that forcing a polluting industry to shut down suddenly will put many people out of work; that outlawing strip-mining will force miners back underground with a consequent return to the old problems of health; and that blocking the construction of a major electric generating facility can deprive the people of an entire city of power.

But also, he said, looking at both sides of a problem implies that there are aspects of hope in even the worst situations.

"Take the Vietnam war, for example. . . . One of the many lessons to be drawn from it is that this country will never again be led into a war without its knowledge and consent. . . . Also, that the draft makes no sense in peace time—that we should pay enough money that men will want to serve. . . .

"Also, the Vietnam war proved something very important about the superpowers, the U.S. and the U.S.S.R." U.S. helicopters in Vietnam could have been "sitting ducks" for Soviet jet fighters, but the Soviets refrained. Despite all the talk of bringing a quick and decisive end to the war, the U.S. refrained from using nuclear bombs against north Vietnamese population centers. And the Soviets did not attack U.S. aircraft car-

riers in the Tonkin Gulf.

"What does all this mean? It means that without the slightest question, the U.S. and the U.S.S.R. are not going to take chances on a third world war . . . it is clear that the group that started it would not survive it—whether because of the enemy or because of their own people."

Alumni Nominees

Breene M. Kerr, '51, Director of Kerr McGee Corp., Oklahoma City, leads a slate of ten candidates nominated for national officers of the M.I.T. Alumni Association for 1972-73. Mr. Kerr is proposed as President; other nominees are: Paul V. Keyser, Jr., '29, Iech M. Pei, '40, and Paul P. Shepherd, '53, for members of the M.I.T. Corporation; Karl R. Van Tassel, '25, and Angus N. MacDonald, '46, for Vice Presidents of the Association; and Bradford Bates, '59, Claude W. Brenner, '47, Charles A. Speas, '42, and John R. Wiley, '33, for Directors.

The ballot will be mailed to all alumni by the end of March, and additional nominations for officers of the Association must be received before March 5 by Frederick G. Lehmann, '51, Secretary of the Association; such nominations require support by signatures of 250 alumni. (A separate balloting will be conducted among recent graduates of the Institute later in the spring to propose members of the M.I.T. Corporation in the category "Representatives from Recent Classes.")

Biographical sketches of the nominees follow:

□ Mr. Bates is a member of the professional staff in the Computer Products Development Section of Honeywell Information Systems, Inc., Framingham, Mass.; he previously held a similar position with Litton Industries, Beverly Hills, Calif. He has been an officer of the M.I.T. Club of Southern California and more recently of the West Suburban M.I.T. Club (Framingham); he is Deputy Chairman of the Alumni Day Committee for 1972; and he has been active in scouting and other community services.

□ Mr. Brenner is General Manager of the Bedford Division, E G & G, Inc., and was previously with Allied Research Associates, Inc., and—shortly after completing his M.I.T. studies—with the Institute's Aeroelastic and Structures Research Laboratory. Active in alumni affairs, he was Chairman of the 1969 Alumni Day Committee and is President of the Class of 1947.

□ Mr. Kerr is a Director of Kerr-McGee Oil Industries, Inc., and senior partner in the Resource Analysis and Management Group, Oklahoma City. He has held important administrative posts in N.A.S.A. and with Kerr McGee Chemical Corp., and he is Chairman of the Board of Kerr Foundation. Mr. Kerr studied geology at M.I.T. and he is a member of the Visiting Committee to that Department as well as of many other Corporation and Alumni Association groups.

□ Mr. Keyser's second term as President of the Alumni Association ends on June 30, 1972; he retired as Director, Executive Vice President and Member of the Executive Committee of Mobil Oil

Corp. in December, 1969, having been in technical management for Mobil and predecessor companies since 1930. He has been a member of the M.I.T. Corporation and/or of its committees since 1964, of the Alumni Fund Board since 1968, and of the Board of Directors of the Alumni Center of New York since 1964.

□ Mr. MacDonald is President and Director of Angus MacDonald and Co., Inc., Stamford, Conn., a management consulting organization. He is widely known as a patron of the arts—including a number of M.I.T. music and arts groups—and is the author of *Middle Ground*, an autobiography. Mr. MacDonald has been a member of the Board of Governors of the Alumni Center of New York since 1966, of committees of the M.I.T. Corporation since 1967, and of the Board of Directors of the Alumni Association in 1968-70.

□ Mr. Pei is founding partner of I. M. Pei and Partners, New York, one of the nation's outstanding architectural firms; he was previously associated with Webb and Knapp, Inc., as Director of Architecture. He has been widely honored for professional activities and has recently been associated with the Alumni Center of New York and with the M.I.T. Art Committee.

□ Mr. Shepherd, who is Senior Vice President of Cabot, Cabot and Forbes Industrial Division, joined C.C. & F. in 1959 and opened the company's San Francisco office in 1963; since then he has been Chairman of a San Francisco Bay Area Council subcommittee, President of M.I.T. Club of Northern California, and a Director of the M.I.T. Alumni Association. He is Second Vice President of the National Association of Industrial Parks.

□ Mr. Speas has been since 1956 Vice President for Research and Development of Hedwin Corp., manufacturers of plastic containers; earlier he held research and development assignments in two aerospace industries. He has been Honorary Secretary of M.I.T. and President of the M.I.T. Club of Baltimore, and he has recently received the Master of Science in management science from Johns Hopkins University.

□ Mr. Van Tassel is Director of A. B. Dick Co., Chicago, having recently retired from the posts of President and Vice Chairman of the Company. He has been active in Chicago business and civic affairs and adviser to business schools at Northwestern University and the University of Illinois; and he has been a leader of the M.I.T. Club of Chicago and—since 1967—a member of committees of the M.I.T. Corporation.

□ Mr. Wiley will retire this summer as Director of Aviation for the Port of New York Authority, having previously served in the management of American Airlines and the Railway Express Agency; and next fall he will become Visiting Professor in the Department of Aeronautics and Astronautics at M.I.T. He has been active in the Alumni Center of New York (General Chairman, 1970-71) as well as in professional organizations in the field of air transportation.



B. M. Kerr



P. V. Keyser



I. M. Pei



P. P. Shepherd



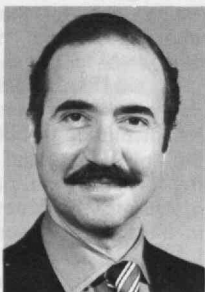
K. R. Van Tassel



A. N. MacDonald



B. Bates



C. W. Brenner



C. A. Speas



J. R. Wiley

A Weekend at the Movies

Film-making as a creative art and as a college subject has spread by now to almost every major American university, including M.I.T. But what sort of films do students make?

Unusual ones, creative ones, pointed or pointless ones, but very rarely dull ones, was the answer which emerged at the New England Student Film Festival at M.I.T. early this winter. The films range from near professional to distractingly clumsy, but they share a distinguishing element of freestyle imagination. Most are short—five minutes, plus or minus, is common, 30 minutes is exceptional. Acting is rare; students prefer the extremes of pure reality or pure fantasy (including animation). And the range of subjects and styles is much greater than can be seen in commercial films, which are constrained to make a point or a profit, or both.

The festival was the second in what is to be a yearly series sponsored by the University Film Study Center, an organization of 13 New England colleges—including M.I.T. Screenings (of over 60 films by students from at least a dozen New England schools) and talk-fests lasted from early morning straight through to early morning again—a taxing schedule for even the enthusiastic audience of several hundred who came to watch, comment, and compare.

Hamburgers and Pinball

Some samples:

□ "Seven Billion Served," a five-minute color film by Morgan Wesson of Hampshire College, is an hilarious tongue-in-cheek documentary of a MacDonald's hamburger stand. Close-ups of beef patties sizzling in rows and columns, mechanical mustard applicators moving quickly down the lines, wrappers wrapping, cash registers registering, and customers chewing indifferently, are shown with a voice-over of interviews. The manager tells us in simple, sincere language about the unique virtues of MacDonald's operations and products—and a salesgirl explains in languid monosyllables that her job is rewarding because of the interesting people she meets.

□ "Zip-a-Doo," a five-minute color close-up of pinball machines—"the great American pastime"—by David S. Griffeath of Dartmouth, lets the audience watch very closely but passively as the steel ball bounces around the machine. The effect is nothing at all like the feeling of actually playing, and that, we must assume, is Mr. Griffeath's point.

□ "Somebody Up There Hates Us," 30 minutes of interviews and conversations with the Slumlords Motorcycle Club, was made by Peter Hoffman of the Yale Art School. We learn how the Slumlords (recently accused of gang rape) feel about their "persecution," and we see them in action—hobbling, crawling, or staggering about at a party.

□ "Some of these Days," a 27-minute black and white film (and one of the most interesting at the Festival) by Martin Ostrow of Brandeis, deals with the relationship between a recreational therapist at a Boston nursing home and

her patients—a remarkably believable documentation of a relationship which is strong and warm and full of love, but at the same time somehow annoyingly unnatural. It has a "movie within a movie," in which the patients pretend to be the famous stars they remember from their distant youths. The same camera for which they are playing their pitiful roles (with constant coaching from the recreational therapist) is also filming what goes on "off-camera."

□ "Party," a two-minute color film by Lew Gould of Emerson, focusses on the surface of a bridge table around which four ladies play cards, conduct light conversation, and enjoy tea and cake. Meanwhile there are flashed on the screen almost subliminally short black-and-white shots of starving black people. The film has a message—if trite.

□ "Film by Denny," a three-minute assemblage in black-and-white by Denny Alsop of Harvard, consists, quite literally, of scraps from the cutting room floor pasted together and set to music. It is clever, original, and great fun to watch.

□ "Flash Flood," a four-minute black and white film by Jerry Lyman of Harvard, is a choreography of scratches—on the frames and in the sound track. The effect is even more delightful than in "Film by Denny," maybe because the technique is even more improbable. Patterns of scratches—the program tells us they were made by scratching directly on the film—dance to a thumping binary beat.

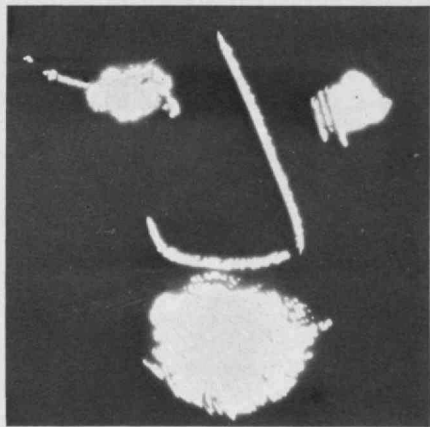
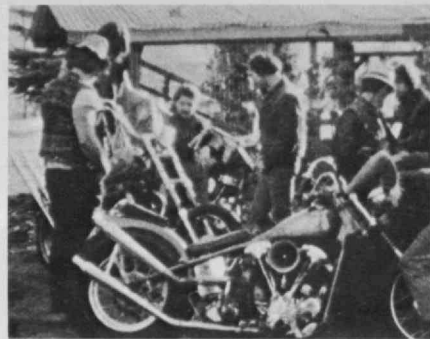
□ In "A Child's Alphabet," a nine-minute color animation by Tom Spence of the University of Bridgeport, line drawings form letters which move about and transform themselves into other figures—animals, people, objects, shapes—with remarkable ingenuity and humor. As the film moves through the alphabet, we suddenly notice that some of the figures formed on the screen are sexual references—bathroom graffiti forming and transforming itself in the wink of an eye in the midst of a kindergarten alphabet. The film was hilariously clever.

Problems and Successes

M.I.T. students showed at least eleven films; most were documentaries, reflecting in part the strong *cinéma-vérité* influence due to the mentors, Professors Edward Pincus and Richard Leacock. One was "Untitled #3," a three-minute black-and-white film by Barbara Moser. Music appropriate for a film about yachting oozes from the soundtrack while we watch scenes shot in an upper-middle-class Boston suburb: houses, a shopping center, a church—and the people who live there . . . including a yawn (notable as the only expression in the film of any feeling) by a young man walking with an old woman.

The more orthodox documentaries from M.I.T. included Christina Barnes's 11-minute black-and-white "The Group School Cambridge," on the problems and frustrations of starting a working-class free school; and Richard King's three-minute black-and-white "Untitled #4," a study of Massachusetts Avenue in Cambridge and daily life along it.

Mr. King, a special student in the film section of M.I.T.'s Department of Archi-

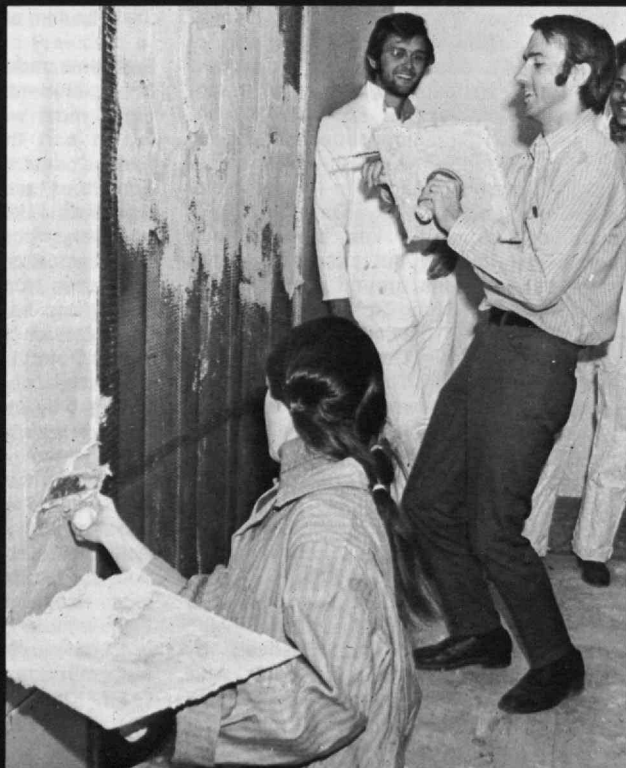


The New England Student Film Festival, held this winter at M.I.T., drew over 60 entries from at least a dozen schools. Above are (top to bottom) the Slumlords Motorcycle Club in "Somebody Up There Hates Us," by Peter Hoffman of the Yale Art School; an elderly patient and clown-costumed recreational therapist in "Some of These Days," by Martin Ostrow of Brandeis; and a scene from "Flash Flood," by Jerry Lyman of Harvard.

ecture, was one of the festival's organizers. He considers it a success, but he admits that it revealed one of the greatest problems of student films—lack of content. Students are more interested in style than in subject, so the making often eclipses the film. Their films tend to be clever but pointless, with too much footage of scenes which particularly please the makers.

Why hold a non-competitive festival? "You can see your own problems in other people's films, and you can see other people's successes, too," says Mr. King.

The Gallery



With help from the Wood, Wire and Metal Lathers Union, the Boston Plasterers Union, and C. George Dandrow, '22, consultant to the Northeast Lathing and Plastering Promotional Bureau, M.I.T. architecture students in a class of Albert G. H. Dietz, '32, have had a first-hand look at metal-lath-and-plaster construction. Henry J. Sheerin, Vice President of the Lathers Union, explained the preparations, union members demonstrated, and then it was the students' turn. But Professor Edward B. Allen (lower right) obviously had the winning style. (Mr. Dandrow and Professor Dietz are shown with students at the top, left.) (Photos: Fay Photo from N.L.P.P.B.)

Complexity at Simplex

When M.I.T. acquired the land formerly occupied by the Simplex Wire and Cable Corp. when the latter vacated its inefficient manufacturing facilities and moved to Maine two-and-one-half years ago, it did so full of resolve and good intentions. The purchase price of \$12.75 million, drawn from the Institute's investment portfolio, would provide not only a modest investment return, but also the opportunity for redevelopment of a run-down industrial area at the edge of the campus into a more sympathetic environment—including places for M.I.T. people to live. Cambridge would benefit from the larger tax base, increased housing stock, and increased supply of jobs, and everyone would win.

The first step was to be housing—but adding to the city's total housing stock was only part of the picture. A goal that was closer to home was to provide sufficiently attractive housing to lure professors in from the suburbs. M.I.T. has long lamented the fact that the campus is left to the students at night; Northgate Community Corporation (see *Technology Review for December, 1971, p. 91*) had staff and faculty housing as one of its original goals, but fiscal complications have severely hampered Northgate's activities. When the Simplex property became available, it was seen as a large opportunity to further these purposes.

The M.I.T. Planning Office mounted a major effort to study the area and plan the new development and its financing, anticipating the construction of housing for faculty, students, and other Cambridge residents and the development of some associated "sympathetic" commercial facilities—stores, offices, and perhaps light industry. But a preliminary report to the Corporation Joint Advisory Committee on Institute-Wide Affairs at the end of the year suggested that the prospects for M.I.T.'s aims may be dim.

Richard P. Dober, Project Director for the Planning Office, summarized the problems this way: housing of the type envisioned would have to rent for about \$400 per month for a typical 1000-square-foot two-bedroom apartment. And it is not at all clear that there would be enough people willing and able to pay that price to fill the planned 1200 units.

Vice President Kenneth R. Wadleigh, '43, noted that a development on that scale—almost \$40 million worth of construction—would be "a very risky undertaking." But D. Reid Weedon, Jr., '41, supported the concern that it might be impossible to undertake the project on a smaller scale: "Unless you substantially change the character of the area, you don't stand a chance of renting an apartment at \$400 per month."

The site is surrounded by a noisy trucking terminal and numerous small industrial efforts, in what Dr. Wadleigh has called "a damned depressing area."

Can It Pay Its Way?

The 1,200-unit plan with which M.I.T. has been experimenting is based on a density of 80 units per acre. It calls for good quality construction, covered parking facilities, and a high level of site

amenities (landscaping, lighting, paving, etc.) Dr. Wadleigh explained, "the staff agrees with C.J.A.C.'s earlier suggestion that the development should be done right if it is to be done at all."

The project's costs, excluding land, will fall in the \$35,000-to-\$40,000-per-unit range. The plan calls for financing with non-M.I.T. funds, including whatever low-cost financing programs are available (e.g. a state program which provides low-cost funds on the condition that at least one-quarter of the units in the development be provided to low-income families as subsidized housing, with rents at about \$108 per month). The land was purchased by M.I.T. at an average price of \$680,000 per acre. Since it was bought from the Institute's investment portfolio, a 5 per cent return is necessary (if the return were dropped to 4½ per cent, the average rent would be reduced by only about \$4 per month).

A survey conducted this year by the M.I.T. Planning Office indicated that of the faculty and staff, 269 were willing to pay between \$300 and \$399 per month rent, and only 105 were willing to pay over \$400 per month for a residence adjacent to the campus. For graduate students, the figures are 98 and 48. Although that is far short of the 900 needed to fill the non-subsidized units, Mr. Dober feels that actual demand might be higher than the figures indicate—if one allows some optimistic assumptions about the cost of transportation, rising costs of alternative housing, and the attractiveness of the housing planned for the "northwest sector." Finally, if the housing units are developed as condominiums (an alternative which Mr. Dober mentioned), demand might be greater.

Now or Never?

Despite all the risks involved in such a venture, Dr. Wadleigh said, "everything tells us that if we are going to build, we should build now. Construction costs appear to be about to 'stabilize,'" he said hitching up an eyebrow, "at an annual increase of about 10 per cent." An alternative to proceeding immediately with the major plan would be to build cheaper low-rise housing designed to last about ten years and hope that the situation would improve in the future. But then the new builders would have the additional problem of dislocation of the tenants of the temporary structures.

The prospects for the commercial side of the development have not been as thoroughly studied, Mr. Dober reported, but it is clear that in that part of Cambridge, "the market is soft and the competition is strong."

Antony Herrey, S.M.'57, Director of the M.I.T. Real Estate Office, added to the uneasy prospects. The Cambridge housing market appears to be softening in response to higher costs, he said. More and more often two couples are sharing one apartment, or six or eight students are banding together to share an apartment which would have been occupied by only three or four a few years before. While the housing supply refuses to expand, people are contracting.

C.J.A.C. members and observers offered a variety of schemes for reducing

NOTE TO ALUMNI AND FRIENDS OF M.I.T.

Students here at the Institute are already examining summer employment prospects and it has occurred to us that some of you may be able to help. As you probably know, it is difficult for students to find jobs in their fields even in a good year, and this year it may be hard to find jobs, period. I don't think I need to tell readers of *Technology Review* how able M.I.T. students are—you read about them monthly.

The help we're asking, then, is fairly obvious; if you know of summer job possibilities, either in your firm or the local community, please let us know so we can, in turn, inform interested students. A benefit which might accrue, beyond a first-rate job performance, would be your establishing a new link with the Institute through the relationship developed. As a result, you and the student might end the summer with a new image of what M.I.T. is—you, because of updated information, and the student, because of some history you provide, as well as a real helping hand.

If you have some leads (or ideas), please drop me a note or just send your name and address on the form below and I'll respond.

Daniel T. Langdale
Director of Student Employment

Mail to: Student Employment Office
M.I.T. (Room 5-120)
77 Massachusetts Avenue
Cambridge, Massachusetts 02139

Name _____

Address _____

Phone No. _____

Comments: _____

the cost, but none of the schemes appeared both viable and consistent with M.I.T.'s goals. They ranged from selling off parts of the project as tax shelters to "doing the construction ourselves."

A member of the committee noted that "the only people making money in real estate today are the people who can use it as a tax shelter." Since M.I.T. has no taxes to pay, it obviously cannot enjoy that advantage—and if it sold off the project, it would lose control and possibly sacrifice its larger purposes. Vincent A. Fulmer, S.M.'53, Vice President and Secretary of M.I.T., suggested that it might be possible to include gift capital in the financing package—but it is not clear whether or not that would represent competition for M.I.T.'s fund-raising activities toward other goals.

At the end, with a gloomy look to his face, Dr. Wadleigh invited the committee to examine the larger question of whether M.I.T. should be involved in the off-campus real estate and development business at all.

Oscar R. Hedlund, 1887-1971

Oscar R. Hedlund, a leading track and field sports figure in New England for 60 years who coached M.I.T. teams in these activities for 35 years beginning in 1923, died suddenly on December 8. He was 84.

As a young man, Mr. Hedlund had himself been a star in track and field sports; he broke the world's indoor mile record at Madison Square Garden in 1914 and ran for the U.S. in the 1912 Olympic Games in Stockholm. During his period as coach of M.I.T. track and field teams, Mr. Hedlund never missed a single practice. Reporting his retirement in 1958, *The Tech* saluted him as "not only a fine track mentor, but also a firm believer in the spirit of M.I.T. athletics and a friend and adviser to countless hundreds of students."

John R. Markham, 1895-1971

John R. Markham, '18, Emeritus Professor of Aeronautical Engineering, died on December 12 at Sancta Maria Hospital, Cambridge, as a result of complications from injuries suffered in November when he dodged to avoid being struck by an automobile in Belmont. He had been hospitalized since the incident.

Professor Markham was born in East Cambridge, and he had been a member of the M.I.T. staff continuously since completion of his World War I service, having entered the U.S. Army from studies in the M.I.T. Department of Mechanical Engineering. Professor Markham's first faculty appointment came in 1930, and he was raised to the rank of professor in 1947.

As a research associate, Professor Markham participated in the 1920's in the design and construction of a series of pioneering wind tunnels at M.I.T. which were essential to the advances then being made at the Institute to the theory of flight and the design of flight



The monumental cubistic buttonhook above is a sculpture in Cor-ten steel entitled "Upended," by Clement Meadmore. It is part of a collection of such works by five American artists temporarily displayed at M.I.T. through the

generosity of the Lippincott Foundation. This one, located outside the Student Center, proved irresistible to a group of students who threatened to match an improbable creation with an irrational act.

vehicles. In the 1930's he directed the design, construction, and operation of the Wright Brothers Wind Tunnel, and following World War II he similarly led the building and operation of M.I.T.'s Naval Supersonic Laboratory. He supervised extensive programs in the design and testing of U.S. military aircraft at M.I.T. during World War II. He retired in 1961.

In addition to these contributions through research and engineering, Professor Markham was considered an exceptional teacher; his students now hold positions of major responsibility in government and in the aerospace industry throughout the world.

Indignation and Passive Resistance

It was an uncharacteristically warm Friday night in December, and the usual influences were at work among a group of 30 or so unaccompanied males at Baker House. Prickled by the thought of impending examinations—and perhaps a bit of sexual frustration—they were made particularly sensitive to the irritations of life.

As it happened, one of the more annoying irritations in the typical M.I.T. undergraduate's life was to be found directly in front of the Student Center, in the form of a massive metal sculpture—part of a collection temporarily displayed in open areas around the campus. Tech men seem to find it particularly galling that an artist—someone who would not know a differential equation if it bit him on the ear—can build something which does not even pretend to do anything, and be paid for it! Such mockery of engineering cannot be tolerated.

So the offended students translated their indignation into affirmative action.

Sections of pipe were produced and the massive sculpture began to move—in a way which several of those present saw

fit to compare with the building of the pyramids of Egypt. The contemplated destination seems certain to have been the middle of busy Massachusetts Avenue.

But the Campus Patrol had other ideas. Recent events have not been lost on the men in blue: their response to the threat was simply passive resistance; they merely parked their patrol car in the path of the slowly-moving sculpture—and waited. Having moved the monster less than 20 yards, the students yielded and calm returned to the campus.

Dean Wick: Back to the Lab

Emily L. Wick, Ph.D.'51, Associate Dean for Student Affairs, left that post at the end of the first term to return to full-time work in the Department of Nutrition and Food Science. "The time has come when I must return to full-time teaching and research if I am to maintain credibility and productivity as an active scientist," she wrote J. Daniel Nyhart, Dean for Student Affairs.

Accepting Dean Wick's resignation, Dean Nyhart said that "more women students owe more to her than they will ever realize." In addition to her assignment as counsellor to M.I.T. coeds, Dean Wick was premedical adviser—and the number of students for whom she shared responsibility in both capacities has increased rapidly since her appointment as Associate Dean in 1965. Then there were 337 women at M.I.T. and all undergraduates lived in McCormick Hall; now there are over 700, living off-campus and in coeducational living groups as well as in McCormick.

Dean Wick came to M.I.T. as a graduate student in 1946, and she joined the faculty in 1959; she was the first woman on the faculty to receive tenure, and—in 1968—the first to be promoted through the ranks to full professor.

New York Assistant Retires

Madalein W. Jones, who has been for seven years the Administrative Assistant to the Director and unofficial "hostess" of the M.I.T. Alumni Center of New York, retired at the end of the 1971 calendar year.

She joined the center in 1964 just as its unique concept of professional services to M.I.T. graduates was taking form, and since then she has been involved "in every aspect" of the Center's many programs, according to James N. Phinney, Director. Especially, he notes, she has been primarily responsible for arranging Educational Counselors' activities at the Center.

Mrs. Jones is a native of Cleveland, Ohio, and attended Western Reserve University.

A Day of China-Watching: Slow Progress of Revolution

First the ping-pong players, then some scientists, and now President Nixon himself. Plainly it is time to find out something about China. The opportunity arose in mid-November, when M.I.T.'s Center for International Studies joined with the Institute's Chinese Students' Club to organize an all-day program of lectures, panel discussions and films.

The day began with Dr. Ethan Signer (see p. 8) and Dr. Paul Dudley White, noted heart specialist at Massachusetts General Hospital, on "medicine and science in China." Dr. White, who visited a number of mainland-Chinese medical facilities this fall, was convinced that the West has much to learn from Chinese medicine: particularly acupuncture, the needle-insertion therapy which the Chinese make no claim to understand themselves—it just seems to work (but then, most Western medicine is no less empirical).

Early afternoon was devoted to learning how the Chinese live. Professor Thomas Bernstein, of Yale's Department of Political Science, told of his recent interviews with young ex-students in Hong Kong. It appears that since 1968 (during the Cultural Revolution) the great majority of students completing their formal studies have been sent to work on the farms—and given to understand that it would be for life. There is no suggestion that they should teach or lead the country people: quite the reverse, they are there to learn to work hard on a farm. The idea, said Professor Bernstein, is to remove the last vestiges of elitism. (Thus, a student who in fact comes of a working-class family stands some chance of being spared the back-to-the-soil treatment.) Many rebel, and if they are anywhere near Hong Kong that is where they head for.

Professor Ezra Vogel, a Harvard sociologist, remarked that so many things still remain to be done that, in a way, the U.S. is more socialist than China. For example, the Chinese government cannot yet afford to give state pensions to old people; it has taken over what functions it can afford to, and leaves the rest, for the present, in the hands of collectives, which compete in the world for profit in

a way that is not entirely un-capitalistic. If the collectives grow larger, this is thought to be in the direction of truer socialism, besides which it aids large-scale planning. But the goal of the finished socialist state, able to "give to each according to his needs," awaits a time of greater prosperity.

One questioner asked how China's differed from other Communist revolutions. Professor Vogel came up with three differences. First, the traditional value placed on moral leadership (which goes back to Confucianism), whereas orthodox Marxism regard material conditions as primary. Second, China is more nationalistic than the East European countries, he said, which gives the political movement a basis of patriotism. Third, of course, the physical vastness and the low technical level of development. In late afternoon, M.I.T.'s China-watcher Lucien Pye presided over an ambitious attempt to shed some light on past and future Sino-American relations. One enlightening generalization came from Daniel Tretiak, of York University, Toronto. When the two countries first met in the 18th century America was a mere colony and China was The Celestial Empire; later, the situation reversed. But now, for the first time, if China and U.S. are to meet at all it must be as equals. (One thing they have in common, he said, is a sense of their own importance.)

On one point Tretiak was echoed, later in the day, by the *Washington Post* China expert Stanley Karnow. China's traditional enemy is Japan. The U.S. has been, and is, a nuclear military presence in Asia, and that in itself is of course troubling to Chinese self-respect. But it is also reassuring—as long as Japan is overshadowed by another power, things could be worse.

Advice to Business; But if They Won't Listen, Charge Them

American industry has trouble understanding the younger generation mostly because its leaders are unable to talk to them.

Acting on this theory, a group of students and recent alumni of M.I.T. have banded together as ECIS (Effective Communication through Interpersonal Relations) and offer themselves as communicators—to meet with small groups of top executives to talk about the generations and how they differ.

ECIS seminars are marked by a format in which the businessmen are comfortable and a vocabulary which they can understand; the meetings are held on company turf, at company expense.

The main point, explains ECIS President Jerrold M. Grochow, '68, is to discuss trends in perception, outlook, and values. All too often, he says, "people try to talk about *your* lifestyle but viewed through *their* experiences. At every session, there is someone who says, 'Just wait until you're 35 and have a mortgage and two kids...'"

Today's young people may have goals which are different from those of the older generation, but Mr. Grochow relates old and young in catch-words chosen for businessmen: "individuality,"

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Martha Donahue, '75, is to be the first woman commissioned into the Air Force Reserve from M.I.T.'s R.O.T.C. program. The idea, she says, is "appealing."

"flexibility," "anticompartamentalization."

In the one year since it was formed, ECIS has held seminars at companies including Union Carbide, I.B.M., General Motors, and Cummins Engine. Their hosts seem pleased, for the ECIS group is often invited back for repeat performances. The 11 members of ECIS are now considering broadening their activities to include written reports and series of seminars to substitute for the one-day meetings.

ECIS offers its service at \$50 per day per ECIS member present, plus all expenses. "Businessmen don't seem to understand free advice," Mr. Grochow explains. "If we charged them twice as much, they would probably listen twice as hard."

M.I.T.'s First Coed in A.F.R.O.T.C.

Martha Donahue, '75, looks forward to being the first girl commissioned into the Air Force Reserve from R.O.T.C. at M.I.T.; the idea is "appealing," she says.

But that's not the basic reason for Miss Donahue's interest in R.O.T.C.: she counts on the Air Force to help her through a four-year dental school after she graduates from M.I.T., and thereafter she will do her dental internship while on active duty in the Air Force.

Problems? Not as many as most readers might think. The Air Force has accepted coeds for R.O.T.C. for two years, and this year there are more than 900 throughout the U.S. There are no concessions in the curriculum, and training facilities are being rapidly equipped to accommodate both men and women. One of the few already prepared is Pease Air Force Base, N.H., which is happily convenient to Cambridge.

Career Development

C. Allin Cornell, Associate Professor of Civil Engineering, has been named to a new Career Development Chair in the Department, established by an anonymous donor "to recognize, in an innovative way, the truly exceptional young members of our faculty," according to Peter S. Eagleson, Sc.D.'56, Head of the Department.

The new professorship will be awarded on a rotating basis to an untenured associate professor in the Department in recognition of outstanding accomplishment in teaching and research, Professor Eagleson said.

Professor Cornell came to M.I.T. in 1964 following graduation (A.B. 1960) M.S. 1961, and Ph.D. 1964 from Stanford University. His particular interest is the application of probability and statistics to various civil engineering problems, especially in the area of structures. His methods of modelling earthquake ground motions and structural responses have found international use in the design of tall buildings and of nuclear power plants.

Preprofessional Guidance

Responding to the growing interest of M.I.T. students in careers in high school education, medicine, and law, President Jerome B. Wiesner has named a special faculty Committee on Preprofessional Advising and Education. Its Chairman is Alan Hein, Associate Professor of Psychology, and its membership will include both undergraduate and graduate students as well as faculty and administration.

The Committee's tasks, Dr. Wiesner said, will be to coordinate and extend preprofessional counseling for students, to keep other members of the faculty informed of trends in student interest; and to promote closer ties with the professional schools to which M.I.T. graduates are likely to apply. It will support a new Office of Preprofessional Advising and Education now being established.

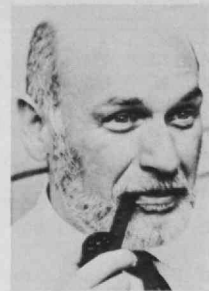
Commenting on the appointment of the Committee, J. Daniel Nyhart, Dean for Student Affairs, noted the rapidly growing interest among M.I.T. students in postgraduate professional training. "There are 170 students applying to medical schools from M.I.T. this fall, in contrast to only 47 four years ago. And we have seen a similar jump in law and education," he said.

Water Environment

"The Water Environment and Human Needs," the symposium marking the dedication of the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics on October 1 and 2, 1970, has now been published in a 365-page paperback book edited by Arthur T. Ippen, Institute Professor who directs the Laboratory. The contents include papers on shoreline processes, offshore engineering, water ecology and circulation, and water resource development. Copies are available from the Laboratory at \$6.



S. E. Miller



Y. Brozen



C. R. Rogers



R. F. Lathlaen



H. J. Bixler



M. P. Andrien

Individuals Noteworthy

To **Lester M. Klashman**, '37, a Distinguished Service Award, U.S. Environmental Protection Agency . . . to **Charles W. Quantock**, S.M.'66, the Navy Achievement Medal . . . to **Stewart E. Miller**, '40, the Morris N. Liebmann Award, I.E.E.E. . . . to **Thomas M. McEvoy, Jr.**, '47, the Engineer of the Year Award, Westchester County Chapter, N.Y. State Society of Professional Engineers, Inc. . . . to **E. Philip Kron**, '34, the National Association of Purchasing Management Award for Outstanding Service, Eastman Kodak Co. . . . to **William Webster**, S.M.'23, the John Fritz Medal; to **Stephen H. Crandall**, Ph.D.'46, the Worcester Reed Warner Medal; and **Horace S. Beattie**, '33, the A.S.M.E. Medal, all of the A.S.M.E. . . . to **Robert J. Silbey**, Associate Professor of Chemistry, M.I.T., a Teacher-Scholar grant, Camille and Henry Dreyfus Foundation.

H. Guyford Stever, Former Dean of Engineering, M.I.T., to Director, National Science Foundation . . . **Yale Brozen**, '38, to Adjunct Scholar, American Enterprise Institute for Public Policy Research . . . **Harold Raiklen**, '47, to Eminent Engineer, Tau Beta Pi Association . . . **Rogers B. Finch**, '41, to Executive Director and Secretary, A.S.M.E. . . . **Cranston R. Rogers**, S.M.'51, to a Director, American Society of Civil Engineers. . . . **Charles H. Stevens**, Associate

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Carlton E. Vanderwarker, '30, to President, Greater N.Y. Safety Council . . . **Robert F. Lathlaen**, S.M.'46, to President, W. J. Barney Corp. . . . **Harris J. Bixler**, '53, to President and Director, Marine Colloids, Inc. . . . **Maurice P. Andrien, Jr.**, '63, to Vice President, Corporate Planning, Kaman Corp. . . . **Bernard G. Palitz**, '47, to Chairman of the Board and Chief Executive Officer, Commercial Alliance Corp. . . . **Horace L. Kephart**, S.M.'69, to Vice President for Finance, Sun Oil Co. . . . **Carl M. Mueller**, '41, to Managing Partner, Loeb, Rhoades and Co.

Deceased

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Emory S. Land, '07, November 28, 1971
Abraham S. Cohen, '08, November 5, 1971
William H. Toppan, '08, November 13, 1971
Hilding N. Carlson, '13, November 23, 1971*
Henry C. Harrison, '13, November 25, 1971
Samuel Knight, '13, November 22, 1971
R. Charles Thompson, '13, December 12, 1971
John R. Markham, '18, December 12, 1971*
Albert F. Sawyer, '18, September 2, 1971*
Samuel Rubin, '18, n.d.*
Carl S. Helrich, '18, n.d.*
Ralph B. Spencer, '20, December 3, 1971
Roy B. Chase, '21, November 13, 1971
William R. Ferguson, '21, November 3, 1971
Leroy M. Hersum, '21, November 26, 1971
C. Harry R. Johnson, '21, November 22, 1971
Ivan C. Lawrence, '21, August 18, 1971
Thomas W. Proctor, '21, November 6, 1971
Ralph M. Cook, '22, November 24, 1971
Randall W. Meech, '22, July 6, 1971
James L. Truslow, '22, November 21, 1971
Thomas J. Hails, '23, November 30, 1971
Oswald J. Kirchner, '23, February 17, 1971
Ping Y. Tang, '23, June 17, 1971
Oliver D. Colvin, '24, October 8, 1971*
John S. Davey, '24, November 25, 1971*
Thomas R. Camp, '25, November 17, 1971*
Richard P. Booth, '25, October 16, 1971*
Rene T. Brosens, '25, November 25, 1971
Leland W. T. Cummings, '26, October 9, 1971
George S. Mikhlapov, '26, November 3, 1971*
Albert B. Fowler, '32, October 23, 1971
W. Robert James, '32, November 2, 1971
Angus McCallum, '34, November 30, 1971
Alfred H. Lawson, '36, n.d.
Herbert A. Finke, '39, November 3, 1971
George M. Kavanagh, '42, November 26, 1971
Sidney Roston, '46, September 10, 1971
Philip I. Perry, '54, October 23, 1971
John W. M. Bunker, H.M., March 21, 1969
Oscar F. Hedlund, H.M., December 8, 1971

* Further information in Class Review

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Come to Cambridge Sunday afternoon and see new displays throughout the M.I.T. campus, on exhibit both Sunday and Monday. The innovative "art and technology" show—an exhibit that has received broad acclaim during its recent U.S. tour—opens new vistas on the close interaction between these two disciplines. A look at the early growth of Tech in "Retrospect: 1861-1916." What's happening in many fields of engineering and science in departmental displays throughout the building corridors. And some of the latest trends in painting and sculpture in the Hayden Gallery and on the M.I.T. grounds. No charge.

International Buffet—Sunday, 5:30 to 7

Enjoy a leisurely repast with your fellow alumni in the Sala de Puerto Rico at the Student Center, with informality the keynote. Continental and oriental cuisine for a scrumptious Sunday supper. An unlimited supply of draft beer is included, and wine will be available. After supper, a fleet of buses to take you to:

Tech Night at the Pops—Sunday, 8:30

Arthur Fiedler conducting at Symphony Hall. An unforgettable experience awaits. Members of the Boston Pops Orchestra, led by the Maestro himself, will play some of their famous hits, from the old classics to today's exciting sounds. A special performance, just for members of the M.I.T. family and their guests, with several surprises planned. A sell-out is expected.

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Panels from 9:30 to 11:15 and 2:30 to 4:45, Monday

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Robert W. Mann, Germeshausen Professor (Mechanical Engineering), M.I.T.

A World Model

Jay W. Forrester, Professor of Management, M.I.T.

Change in Society

Paul A. Samuelson, Professor of Economics, M.I.T.



Memorial Service—Monday, 11:30 a.m. to 12 noon

A distinguished M.I.T. alumnus leads a tribute to those no longer here—a solemn moment in the M.I.T. Chapel.

Alumni Day Luncheon—12 noon to 2 p.m., Monday

The traditional Alumni Day event in Rockwell Cage, with several non-traditional events added. Report to the alumni by Jerome B. Wiesner, President of M.I.T.

Gala Soiree—5 to 6:30 p.m. Monday

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Plan now to attend. Watch for reservation forms or call or write the M.I.T. Alumni Association, Room E19-439, Cambridge, Mass., 02139. Act promptly—a sell-out is assured.

M.I.T. and the Ottauquechee

Three M.I.T. civil engineering students spent the summer of 1971 studying environmental control as a moderator in the confrontation of rural and urban life near Woodstock, Vermont. The local verdict: "We cannot begin to tell you how helpful they were to us."

An old New England farm home was headquarters in the summer of 1971 for what the *Vermont Standard* referred to as that state's first cooperative program involving a leading university and a regional planning commission. "Thanks to Massachusetts Institute of Technology's making three of its civil engineering students available to the Ottauquechee Commission for almost three months," the article quoted Chairman Fred Nilges of the Commission as saying, "the Commission has had valuable assistance for its planning work. In return, we hope that the students may have gained new insight into some of the problems which confront those who are responsible for regional planning."

Talbot House—the "old New England farm home" referred to above, which was a gift of the Laurence Rockefellers to M.I.T.—is located next door to "Suicide Six," a famous ski hill in south Pomfret. This puts it some three miles north of "the Green" in Woodstock, a village that has been named one of the five most beautiful in the United States.

In turn, Woodstock lies near the center of the Ottauquechee watershed, a typical still-largely-unspoiled Vermont valley some 40 miles long and averaging half as wide. The valley was once an important agricultural area, and farming still continues; but real estate developments, often featuring vacation or "second" homes, are springing up in what was recently farmland.

The problems this brings are far from uncommon in northern New England; but they are accentuated in the Ottauquechee region because two major interstate highways, Route 91 from New York and Route 89 from Boston intersect in the vicinity. After years of comparative isolation, the region suddenly finds itself within a few hours' drive of major population centers. The Ottauquechee Valley is also especially aware of change because of the Killington ski development at the west end of the valley and the more recent activity of Quechee Lakes Corp., above Quechee Gorge.

But concern for change and development is now an issue throughout Vermont, and the belief that developments, large or small, must have environmental control if the interests of the general public are to receive proper consideration is gaining acceptance. "There is no

way of avoiding the future," wrote Henry T. Bourne, who was instrumental in founding the Ottauquechee Commission, "but there is a way of planning for it, particularly to preserve the characteristics of the area of which we as Vermonters are so proud and love so much." Thus the Vermont Planning and Development Act authorizes towns to join in the creation of planning commissions. Such commissions are authorized to prepare plans covering many different aspects of a region, ranging all the way from economic development to land use; and they and their technical staffs are to encourage and assist constituent towns in the development of their own town plans and zoning ordinances.

The Ottauquechee Commission was one of the first organized under this act. It was unique in that its interests extended over all the towns in an entire river valley; thus it comprised for planning purposes a closed water supply and waste disposal system.

The importance of participation and widespread backing by citizens was recognized from the earliest days of the Commission. Advisory committees on subjects ranging from historic sites to employment opportunities were formed;

and these citizen groups played vital roles as the program developed.

Regional Planning in a Rural Context

During the fall of 1969, Mr. Rockefeller, a Life Member of the M.I.T. Corporation, discussed these matters with James R. Killian, Jr., '26, who was then Chairman of the Corporation; it was suggested that the Ottauquechee effort might well be of sufficient importance—as an example of regional planning in a rural context—to be in some way useful to the educational program of the Institute. This suggestion was passed along to a number of the Institute's departments; and the Department of Civil Engineering took the initiative of exploring the proposal in depth.

No one need be surprised that the civil engineers' response was so positive. Alone among civil engineering groups in U.S. universities, the M.I.T. Department had introduced a course in the Conservation of Natural Resources during the 1950's. And its curriculum had been revised in 1960 around the theme of "the fulfillment of human needs through the adaptation and control of the land-water-air environment." The curriculum now remains dedicated to "creating the com-



The scene: the office of the Ottauquechee Commission, Woodstock, Vt. The time: summer, 1971. The characters: three M.I.T. civil engineering students—

Bradley P. Schrader, '73 (left), Thomas A. Weiss, '72, and Rebecca Grant, '71. Their assignment: to help one Vermont valley chart its course into the future.

plex systems of constructed facilities required to meet such public and private needs as economic development, environmental protection, and quality of life."

Late in the fall of 1969 Peter S. Eagleson, Sc.D. '56, Head of the Department of Civil Engineering, made an investigative trip to Woodstock with Professors Robert J. Hansen, Sc.D. '48, and T. William Lambe, Sc.D. '48. Their interest was further whetted, but it was not clear at this point just how the Department could benefit the Commission and how the project might in turn benefit M.I.T. "It would be a mistake for us . . . to embark on a program without first obtaining a much more intimate knowledge of the total operation," Dr. Eagleson wrote the author, in asking him to make a detailed study. So it was that during the academic year 1970-71 I devoted an appreciable amount of time to this pleasant and productive task.

By the spring of 1971 the Commission had substantially completed its regional plan and Vermont had passed its so-called Act 250, providing for a statewide land-use plan and for application of environmental as well as social and economic criteria to the control of major developments of all types. Encouraged by these events and even more so by the close relationship which had developed between the Department and the Commission during the preceding months, it was decided to initiate a modest pilot program during the approaching summer, bringing M.I.T. students to work on Commission projects in Woodstock. Only three students could be accommodated for this first year, partly because of space restrictions in the office of the Commission where the students would do a portion of their work. These three were chosen to work on the project from more than a dozen promising applicants: Rebecca Grant, a graduate from Port Huron, Mich., Thomas A. Weiss, a senior from Northfield, Vt., and Bradley P. Schrader, a junior from Shaker Heights, Ohio. They lived from mid-June through August with the Commission's landscape architect Robert Longfield and his wife Bernadette at Talbot House.

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The students' program involved two major parts: an office portion, working primarily with the staff of the Commission; and a project portion, conducted in the main under the general guidance of the writer and involving about one-third of the students' time.

The office work, under the supervision of Mr. Longfield, involved assignments essential to the normal operation of the Commission—drafting and the preparation of plans for the several towns of the Ottauquechee Valley. (It may come as a surprise to some readers to learn that all three of these students turned out to be excellent draftsmen.)

In the project portion of the program, each student worked out an individual project and wrote a report on a subject pertinent to either regional or town planning in the Ottauquechee Valley. Each student chose a project of his own liking, subject only to the approval of the



Three M.I.T. students working for the Ottauquechee Commission in Woodstock, Vt., in the summer of 1971 are joined by Mr. and Mrs. Robert Longfield (left), John B. Wilbur, '26, Professor of Engineering, Emeritus, at M.I.T. (back seat),

and the Stanley Steamer of Donald Bourden, an employee of the Commission who occasionally uses the car to tour Woodstock Inn guests. (Photos: Mary Price)

writer, whose main concern was to see that the topics chosen did not seem to be either too comprehensive or too complex to be worked on in reasonable depth within the time available.

Miss Grant's choice was a study of economically feasible methods to reduce stream pollution generated in a portion of the village of Bridgewater, where the topography of the narrow valley is such that many of the homes now discharge their wastes directly into the river. She proposed to construct a community leaching field to handle all of the domestic waste draining from the eastern half of the village, and her study showed that the proposed field had good economic as well as technical possibilities.

The job of considering an adequate future water supply for residents of Taftsville was Brad Schrader's project. Looking ahead to a time when ground- and well-water may become increasingly uncertain in that area because of increased water usage, he recommended that a reservoir storing water in Happy Valley Brook could serve as a reliable source of supply. His project involved a study of the hydrology of the watershed involved, which he undertook in part because he wanted to know more about water resources, a field which he thought he might wish to emphasize in his future studies at M.I.T.

Tom Weiss, the only Vermonter of the three, studied the Ottauquechee River corridor, a quarter-mile strip of land on either side of the river from Bridgewater east through Woodstock to Taftsville. He was concerned because "this part of the region is under intensive pressure for development which, if uncontrolled, could jeopardize the area's unique rural quality and scenic charm." His study involved a painstaking investigation of existing land use along the corridor as well as

of possible sites which might be used for development without spoiling the character of the valley. Tom's chief aim was to help keep this corridor from becoming blighted by strip development, which has ruined parts of Vermont and the nation.

In addition to these Commission and project experiences, the students spent every Tuesday evening in informal discussion sessions with local residents active in the affairs of the Commission. In these sessions the students sought to learn more about the region, its many problems, and what the Commission might do to help solve some of them. The writer spent part of each week—including Tuesday evenings—at Talbot House and in the Woodstock area.

It was judged in the beginning that this cooperative venture, to be counted as wholly successful, must result in a unique educational experience for the students—which indeed it did, and in no small measure because of the extraordinary cooperation of the Commission and its staff—and, as well, that it must serve a thoroughly useful purpose to the Commission itself. A letter from Adrian A. Paradis, Administrative Secretary for the Commission, to Professor Eagleson is assuring on this latter point: "The Commissioners (have) instructed me to convey to you and to the Institute their deep gratitude for making the three students available to the Commission during the past summer.

"We cannot begin to tell you how helpful they were to us, how well behaved they were, how well disciplined they were to carry out their work assignments, and—in short—what delightful young people they were. All of us who worked with them had a most enjoyable experience. . . . We hope," Mr. Paradis added, "that it will be possible to do this again next year."

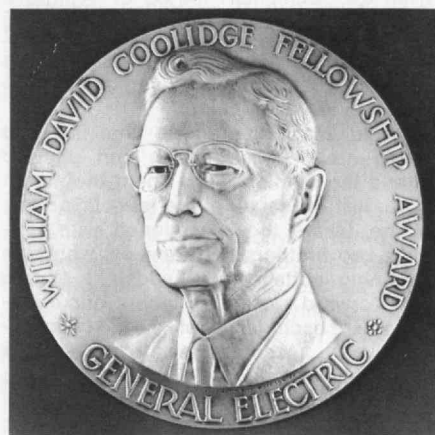
Class Review

95

Here we are in 1972 and I am extending best wishes for a good year blessed with health. How wonderful it would be if Peace were the gift of this New Year!—**Andrew D. Fuller**, Secretary, 1284 Beacon St., Brookline, Mass. 02146

96

Over the past sixty years, Dr. **William D. Coolidge**, '96, has been the recipient of a score of medals from various learned societies both here and abroad. He has now placed all of them on permanent exhibition in the Research Laboratory of the General Electric Co. He has an album containing excellent color photographs of both sides of all the awards and I was



fortunate to have him show it to me on my last visit. Of all these high honors none seemed to give him greater pleasure than one which was not awarded to him and which is shown above. The Coolidge Fellowship Award was first given in 1970 and is to be awarded annually to some member of the staff at the laboratory which Dr. Coolidge once directed and where he carried on his research.—**Clare Driscoll**, Acting Secretary, 2032 Belmont Rd. N.W., Washington, D.C.

98

Another birthday in March. **George Newbury** will be 96 years young on the 28th,

and we hope he has a happy day.

With spring coming along, we suppose **Bob Lacy** is thinking again of going to his summer home in Maine. He wrote from Baltimore, Md., about his previous stay as follows: "I had a pleasant summer at Squirrel Island, Maine with two parts in the Vaudeville, and discovering through my A.S.C.E. charm that the piano player, Larry Pratt, is the son of my classmate and intimate friend, **R. Winthrop Pratt**! How small is our world." It would have been fun, wouldn't it, to see the show?—**Mrs. Audrey Jones Jones**, Acting Secretary, 232 Fountain St., Springfield, Mass. 01108

05

The highlight in my personal life recently was a trip to Troy, N.Y., to help celebrate **Charlie Smart**'s ninetieth birthday on November 19. Ruth and I flew out on the day before and were met at the airport in due ceremony. For the next few days we were pampered by Charlie and Isabel and by a host of neighbors. East Acres in Troy where the Smarts live is populated by the most friendly and democratic people we ever encountered; hence the word pampered. The birthday dinner was held in the famous University Club in Albany. After the dinner and some bubbling toasts, Charlie was roasted with some joke presents, which he countered with his rare bits of humor and a song in high tenor which made me wonder how he ever got through M.I.T. without being tapped for the Musical Clubs. One of the highlights was the receipt of a telegram from his thirty classmates from all over the country wishing him many more years of happy and healthy life. This brought me into an explanation of our still active nonagenarians, canoeists, bird watchers, power squadron commodores, chemical engineers, globe trotters, land appraisers, yacht-racing youngsters that convinced the crowd that 1905 still drinks at the Fountain of Youth.

On another day Charlie took us to the Gurney Museum of antique (and modern) surveying instruments, which he had built into the Gurney complex during the past 40 years. On display were 160 instruments of domestic and foreign make, which Charlie had acquired by travel and correspondence. Amongst

them were some Buff and Buff instruments (some before, some after our Henry XIII entered the firm). It is, and always will be, a monument to Charlie Smart, and he is still at it—his lines out for more instruments, which he hopes to acquire. Anytime anyone is anywhere near Troy, do make an effort to see this museum, and Charlie and Isabel, who was, of course, the "producer" of the birthday celebration.

Since that time, and in an effort to catch up on my birthday card correspondence, I was surprised to find the number of 1905 men entering the nonagenarian class at about the same time—Charlie Smart on November 19, **Prince Crowell** and **George Prentiss** on the 27th, and Hub Kenway on December 1. Here's wishing them all a healthy and happy 1972 and more.

In the last few months I have been lucky to have supported some of my news items with pictures of some of those mentioned in the article. I'd like to keep that up. Some of us haven't seen some of the others since 1905. Why not send a mug shot? A glossy print please and a bit of recent news.—**Fred W. Goldthwait**, Secretary, Box 231, Center Sandwich, N.H. 03227; **William G. Ball**, Assistant Secretary, 631 Fordham Place, Bradenton, Fla. 33505

08

We have received a brief review of the past 65 years of an important member of our class, Professor **Howard B. Luther** of 2570 Grandin Rd., Cincinnati, Ohio. "In 1915 when the M.I.T. buildings were still on Boylston St. and nearby Boston grounds, I was Assistant Professor and by chance, secretary of the Faculty Club, which put me in touch with important men on the faculty and many administrative officers. This led to many interesting activities, one of which was a Faculty Club dinner I arranged. The guest of honor and speaker was Charles W. Eliot, President-Emeritus of Harvard. He had been a professor of chemistry at M.I.T. back just before 1870. The move in 1916 to the Cambridge side of the Charles River enabled me to have a pleasant office for myself. Though absent for a time during the days of the First World War, to serve in Washington, I still had my position at M.I.T. until I left for Cin-

cinnati in 1921. During those years I had many students who in their middle-age have very pleasantly remembered me and talked with me on occasional M.I.T. Alumni Days to my happiness. In Cincinnati I had charge of the Civil Engineering Department of the University of Cincinnati and fortunately had many able students in those days. A few of them have remained great friends whether they live here or have moved away to work elsewhere. In many respects I could still carry on with professional work, but much of that has slipped from my mind. In 1951 at the age of 65 I retired.

"Soon after that I came to the Federal Reserve Bank building, where I still am, to share a double office with my brother-in-law Clifford R. Wright. He died about five years ago and I removed to an office on the same floor, entering a room for a secretary and then my own room. In the mornings, I attend to business affairs, then return home for lunch and enjoy our grounds in good weather when there are many flowers varying with the season."

We are sorry to report the deaths of **Frank W. Willey**, EE, of 3338 Observatory Ave., Cincinnati, Ohio on August 22, 1970; **William H. Toppan**, CH, of Evergreen Manor, 1130 North Westfield, Oshkosh, Wis., on November 13, 1971; and **Abraham S. Cohen**, ME, of 101 Tremont St., Boston on November 5, 1971.

Registered for the President's Inauguration were **Leo Loeb** and Joseph Wattles. . . . The Alumni Association reports the following changes of address: **Alexander M. Emerson**, AR, 588 Main St., Acton, Mass. 01720; **William R. Heilman**, ME, 211 S. Bond St., Scottsborough Inn, Berkeley, Calif. 47170.—**Joseph W. Wattles**, Secretary, 26 Bullard Rd., Weston, Mass. 02193

10

I have received notice that Captain **Ernest L. Patch** died on October 10, 1971.

Max C. Sherman for the past 30 years has lived in Newmount Farm, Claremont, N.H. He celebrates his 60th anniversary next year with 11 grandchildren and 13 great-grandchildren. . . . I have talked with **George Lunt** by telephone and he is in good health and expects to take a trip to Hawaii in January. . . . I heard from **John Barnard**, and he is also in good health and enjoying life on Cape Cod. . . . **Ralph Horne** is very active and is kept very busy. He is one of the trustees of a local bank in Malden. . . . **John Gray** comes to Boston daily but is not active as his eyesight is very poor. . . . **Hiram E. Beebe** has been on the Southern California M.I.T. Board of Governors for 30 years on three of the Southern California Directory Committees and was Club Secretary for five years. From Hiram I received the following poem:

When you get to Heaven
you will likely view
Many folks whose presence there
will be a shock to you.
But keep very quiet,
Do not even stare;
Doubtless there'll be many folks
Surprised to see you there.

I have received word from **Walter S. Davis** as to what he has been doing for the past number of years, but due to my filing system have misplaced his letter. . . . I received a call from **Allen Gould**. He seems to be enjoying life. . . . I have been cured of the cataracts. I am able to see better and expect to keep the files in better condition than I have for the past year so that class notes will be more complete.—**Herbert S. Cleverdon**, Secretary, 112 Shawmut Ave., Boston, Mass. 02118

11

In November I received a letter from **Minot Dennett**, who is now living in St. Petersburg, complimenting Jim Duffy on his account of the reunion which was printed in the Class Notes. He told of a trip he and his wife were planning for six weeks in Guadalajara, Mexico. A month later I had a Christmas card from him from Mexico with the printed sentiment in Spanish. He sent kind regards to all classmates. . . . On the back of the envelope in which he sent his contribution to the Alumni Fund, **Lloyd Cooley** wrote "Retired to Sarasota, Fla., in 1969 and enjoy it very much including the local alumni club. Had a pleasant summer near St. Joe, Mich."

Robert O. Wood of 108 Bellevue Ave., Montclair, N.J., passed away on July 1 of last year. He was born in 1889 in Everett, Mass., graduated from high school in Concord, Mass., and from M.I.T. in Course XIV, electro-chemistry. He spent all his working life in New Jersey.

At the reunion last June two of the boys asked me where I got the money to pay my expenses as Secretary and those of the Reunion Committee. They seemed to expect that class dues were in order. I don't need them. Many years ago Dennie collected enough money, the balance of which has come down to me, to pay my expenses for the foreseeable future. I do not want to publish the figures, but if any of you want an accounting, write to me asking for it. And put in something about yourself so that future notes will not be as short as this month's.—**Oberlin S. Clark**, Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

12

Greetings to you all! I am sorry that news for this issue is scant. Replies to my last letter, sent to 60 classmates, have been few. Last year, we did splendidly, with contributions from well over 100 men. However, if we are to continue the splendid record we have made during the past five years, we must keep the letters coming, preferably something every six or eight months. Just a few lines will suffice.

Larry Cummings has prepared a detailed report on his auto trip with Julie last October, visiting Colorado, New Mexico, Arizona and California. They both enjoyed it immensely though it was at times, a rough one. They first drove from Indiana to Denver where they visited friends, then on to Grand Junction, Colo.,

where they signed up for a two-week "Thru the Lens" bus tour with a party of 24 avid photographers, one of whom took 3,000 pictures with his new camera, or an average of nearly 200 shots a day. Whenever the bus stopped they scattered in all directions, some up the hills, some down, some on the belly, some on the back, and he saw one sitting on a tombstone. The tour included the Grand Mesa and the Black Canyon of the Gunnison River and many other side trips to sights throughout the mountains seldom visited by tourists. Arriving in Indian country they spent two days at Canyon de Chelly enjoying its fabulous scenery, evidenced by the fact that Larry took some 140 views of it. The canyon's formations, old caves, and prehistoric cliff dwellings indicate occupancy for nearly twenty centuries, including the Indians of today.

Then off to Lake Powell for a 125-mile boat trip to the famous Rainbow Bridge, visiting the new Glen Canyon Dam which will raise the water level nearly 600 feet. They were most interested to see the Navajo National Monument, occupied by Indians for many centuries. The various ancient dwellings, one having a roof nearly 500 feet high and 135 different rooms, are still partly inhabited. At Monument Valley they viewed a masterpiece of nature with its spires, turrets and mesas rising up to a height of 2,000 feet above the floor of the valley. This area of 1500 square miles with its ancient Indian carvings, is also inhabited. After many more interesting side trips they returned to Grand Junction where they resumed their personal tour of Bryce and Zion Canyons, Las Vegas, Mt. Whitney and Los Angeles, visiting friends and relatives at Laguna Beach. Returning home, they made other stops to visit at Scottsdale, Ariz., Salt River Valley and Albuquerque, N. Mex. They had covered about 6,000 miles and had to replace five tires and one air conditioner. Our congratulations to Larry and Julie!

Harold Manning reports that he and Helen are in good health and plan to attend the reunion. They spent the month of August, as usual, at the Isle of Springs, Maine, where they vacationed with Harold's two brothers and families, who own adjoining cottages. He adds, "I always look forward to reading about our classmates in each issue of the *Technology Review*." . . . Again, I hear from our good friend, **Jim Cook**, who is still taking his daily walks about the quaint old town of Marblehead, Mass., which he likes so well. "My two married daughters got together and took an eight-day tour of Colorado, New Mexico and Arizona this fall. Unfortunately, they contracted bad colds and Mary has been hospitalized. Glad to see my photo in the news, which I could readily recognize. Your class notes are wonderful, Ray. We all love them. See you next June." . . . A very short note was received from **Bill Rhodes**, which reads, "From one who knows; avoid antibiotics as you would the plague, for their side effects can cripple you for a long time." Apparently from this, Bill has not been in good health. We have sent our sympathy and have asked that, if possible, he send us details. . . . **Fritz Shepard** writes that his arthritis

continues to give him much difficulty in getting about. He says his nephew, Alan Shepard, Jr., the first man in space and commander of Apollo 14, is now a Rear-Admiral. President Nixon has also named him a delegate to the United Nations in New York. . . . We have learned that **Phil Dalrymple** who retired from Jackson and Moreland in Boston last summer after many years of service, has returned to work. Expressing surprise at the request to return when there were so many others unemployed, Phil was told, "That is true, but what we need is a real engineer." . . . **Jerry Hunsaker** writes that at 83, he is in good general health. He still drives his car, although he finds his eyes are not quite as good as formerly. As we know, he has an office at M.I.T. where he attends various seminars. He also attends various professional society meetings in different cities, and recently served as an honorary pallbearer at the funeral of Vice-Admiral E.S. Land, a navy man and former Tech instructor. Jerry still lives alone in his home on Louisburg Square, Boston, where he often entertains his children and grandchildren. We congratulate him on the arrival of his first great-grandson last summer. He continues to spend his summers at the Ausable Club in the Adirondacks.

I have just talked with **Albion Davis** regarding our 60th Reunion, June 2-5, and he says that the replies to his letter are coming in slowly. Over 40 men have written me they are most interested. There are now but four months left before the big event and though two months will have elapsed before this is published, it is now getting late to make the necessary reservations at McCormick Hall. For this reason I am asking all who have not written Al to do so. Remember, we have set our goal at forty men. Let's go. This may be our last reunion.—**Ray E. Wilson**, Secretary, 304 Park Ave., Swarthmore, Pa. 19081

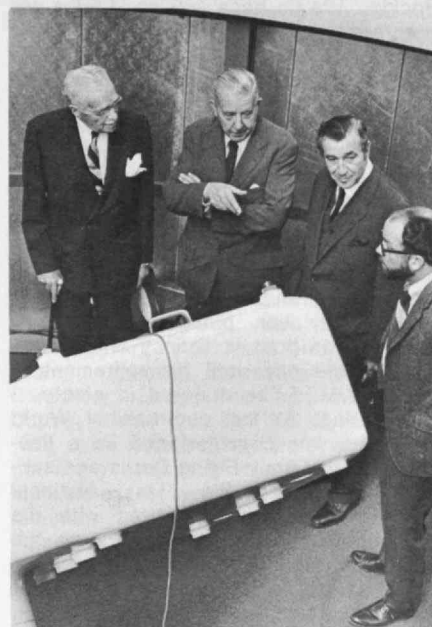
13

The year 1972 is here. I hope you and yours enjoyed the holidays. We (as of December 8, 1971) will enjoy for a couple of weeks the company of our daughter Janet, and her husband, Raymond Ruder. They have built a house in Fallbrook, Calif., so they will winter in a sunny and warm climate, and in April return home to Maine. It is always a pleasure to hear from our classmates, and we quote a message received through the M.I.T. Alumni Fund from **Fred Lane**: "We have been wondering how you are getting on in Maine. We tried for a trip into the Finger Lake region of New York, but after fighting rain for ten days, we turned around and came home. It has been raining in Maryland much of the time since."

We still marvel at what Alice and **George Wallace** have contributed to their city of Fitchburg, Mass., to M.I.T., and to other institutions. It is with great satisfaction and pride that we record George's latest donation to M.I.T. and the rest of the scientific world. The George R. Wallace, Jr. Astrophysical Observatory in Westford, Mass., was dedicated on Oc-



Above: Mr. and Mrs. George R. Wallace '13 are toasted at the dedication ceremonies for the new Wallace Astrophysical Observatory. Right: Mr. Wallace, Drs. Killian and Wiesner and Professor Thomas B. McCord examine one of the Observatory's facilities.



tober 14, 1971. George Rodney Wallace, Jr., a member of our class majored in chemical engineering. A resident of Fitchburg, Mass., he was president and later chairman of the Fitchburg Paper Co., and for many years has been a noted civic leader. A pace-setter in applying advanced technology to the manufacture of papers, Mr. Wallace earned a wide reputation as an innovator in the paper industry. In 1970, The George R. Wallace Civic Center and the Alice G. Wallace Planetarium, named in honor of Mrs. Wallace, were donated by him to the city of Fitchburg as he had earlier donated the Wallace Public Library. In his honor, the city of Fitchburg has established the G. R. Wallace Creative Citizen Foundation to finance a perpetual fund to reward creative students who have shown enterprise in creating citizenship projects "with the same spirit and civic attentiveness always displayed" by Mr. Wallace. With extraordinary energy and foresight, he has served the causes of conservation for many years both as a director of the Explorers Club and as president of the Explorers Research Corp. His diverse activities include a long-standing interest in sponsoring research on clear air turbulence, as well as the protection of the nearly extinct Peruvian condor, the world's largest bird. He is involved in exploration for the detection of ancient sunken ships off the reefs at Bermuda and represented the Explorers Club on an expedition to the South Pole. On two occasions he was guest soloist, playing the electric organ, with Arthur Fiedler and the Boston Pops Orchestra and as a participant in the M.I.T. musical clubs he became an outstanding banjo player.

The Wallace Observatory brings to M.I.T. a versatile facility for research and teaching in optical astronomy—one of the oldest branches of science. A more detailed report of the Observatory's facilities appears in the December, 1971, *Review*, page 91. The Class of 1913 expresses its great pride and extends its gratitude to George and Alice Wallace.

That "world traveller," **Jack Farwell**, sent this post card missive from Paris, France: "Here for an inspection of Paris, my former home territory—back to Connecticut, via London, in a couple of weeks." It is heart-warming to receive letters and news from any of our classmates who live in other countries, but do return to the good old U.S.A. . . . **William S. Gilmore**, based in Bermuda writes: "As to the 60th Reunion, I should certainly like to attend it, but I cannot say I expect to do so, as it is quite a bit in the future. Although I do not feel I can make engagements for the future, I am fortunate to be quite active, and both myself and my wife are enjoying the life here in Bermuda. I came here in 1940, working for the government, and when the job folded, I decided that there wasn't another place as delightful as Bermuda, and we bought a property, settling here for good. My daughter Beryl lives in Dobbs Ferry, N. Y. We visit each other every few months, and my other daughter, Vivienne is living on our property. Her husband is very busy as an architect here. I keep quite busy with the upkeep of things, and with the nearly year-round favorable climate, can enjoy sailing, fishing, and even a bit of water skiing. The remarkable thing about Bermuda is that it is not crowded. There are lots of little islands, most of them uninhabited, with sandy beaches, where the whole day can be spent in quiet solitude. The inland waters are ideal for sailing; all this with the most up-to-date conveniences within close reach. If any classmates come to Bermuda, I would be very pleased to meet them. I can always be reached by phone."

The **Larry Hart** family left New York City for the wilds of the Rockies, and we offer you their letter: "Here we are in Colorado, two months today. We have moved to Boulder permanently, and of course we are delighted beyond words to be near Jo and Bill, about 25 miles away. Then too, I have a sister here in Boulder, so we are among family here in the

Rockies. We do hope you good folks are very happy in your new home, and that you are enjoying the 'mostest of the bestest' every day." We know how wonderful it is to be near our families.

With all of the good news which we receive, there still exist those moments of sadness. We are indeed very much saddened at the passing of our classmate and dear friend, **Hilding N. Carlson** who died on November 23, 1971. "A retired dean of the Boston University School of Engineering, and one of New England's foremost aviation pioneers, Hilding N. Carlson was born in Quincy and a resident of the city until his retirement in 1960. At M.I.T. he majored in electrical engineering. At the outbreak of World War I he was commissioned as a lieutenant in the Army Flying Corps and subsequently joined the Mass. National Guard from which he retired with the rank of major. After four years on the faculty at Wentworth Institute, and five years as an engineering consultant for firms in New England, Dean Carlson joined the Boston University College of Business Administration as a professor of science and mathematics. In 1928, he founded the school for technical aeronautics training at what is now Logan Airport and 22 years later the school was absorbed by Boston University as the nucleus of the College of Industrial Engineering. Under his direction, until the school became a separate college at B.U. in 1950, more than 5,000 aircraft and engine specialists were graduated from the facility which was the oldest institution of its kind in the nation. Dean Carlson, who was also one of the founders of the 101st Observation Squadron of the Mass. National Guard, now the 102nd Fighter Interceptor Squadron, noted among his school graduates General Henry H. 'Hap' Arnold, who later was to head all American Air Force activities in World War II. A trustee of Fisher Junior College, Boston, and the recipient of an honorary doctor of science degree from B.U., Dean Carlson was a past president of the Boston Rotary Club, a member of the Salem Lutheran Church of Quincy, and a former member of the church council. He leaves his wife, Ethel (Swanson); two sons, two daughters, 13 grandchildren and three great-grandchildren." Ethel and Hildy have always been among our closest friends and have participated in all of the 1913 reunions and M.I.T. events. We shall miss Hildy, and we extend to Ethel and the family our heartfelt sympathy. We as a class have contributed to the Hilding N. Carlson Memorial Fund of the Salem Lutheran Church in Quincy, Mass.

We have also been informed that three other classmates have left this life for a more placid realm. **Edgar H. Weil**, 23811 Chagrin Blvd., Cleveland, Ohio 44124, passed away on October 1, 1971. **Samuel Knight**, 925 E. Hampton St., Tucson, Ariz. 85719, died on November 22, 1971. **Henry C. Harrison**, 94 Bayview Ave., Port Washington, N. Y. 11050, passed away on November 25, 1971. Cards of sympathy have been sent to the families of our departed classmates. If any of you have further information of these friends, please write us so that we may add to

our monthly notice. We also must add our sympathy to the Cutler family, on the death of Mrs. Leslie B. Cutler, M.I.T.'28, November 18, 1971. She had a very busy and noteworthy career as a mother, a town official of Needham, Mass., a state representative and state senator. She will be greatly missed by her many close friends and associates, who have known her over the years, as we have.

The new addresses are: Laurence C. Hart, 1850 Folsom, Apt. 308, Boulder, Colo., 80302. Elias W. Hartford, 1956 Belding Rd., Palm Springs, Calif. 92262. So until the next issue, keep the letters and news coming in. Roz and Phil are anxious to hear from you.—**George Philip Capen**, Secretary and Treasurer, **Rosalind R. Capen**, Assistant Secretary, Granite Point Rd., Biddeford, Maine 04005

14

In reporting last month that I'd been appointed to serve as class secretary until our next reunion, I should have added that it was **Leicester Hamilton** who made it possible for me to take on that job. As an emeritus professor with an office (Room 4-254) in the Department of Chemistry, Leicester gets my pencil copy for the class news beautifully typed to send to *Technology Review*. My thanks go also to the typist who does such good work.

Henry Aldrich writes that his son, Richard W., was on the staff of the Radiation Laboratory at the Institute, and a part-time graduate student, during World War II; and that Richard's son David is now an M.I.T. undergraduate. It's probably not very common for three generations in a family to attend the Institute in succession. . . . In response to my plea for news, **Alden Waitt** wrote that he and Kathryn got back to San Antonio in September after three months in the north, and added, "We had a cottage at Brewster for July and another on the other side of the Cape at Chatham for August. Coming and going we stopped off at Alexandria with our daughter, who spent the summer with us and drove both ways from San Antonio. Two granddaughters and a great-grandson spent most of July with us at Brewster. Had a lovely summer. I painted non-stop for two months while the rest of the family went sight-seeing, clam-digging, and swimming."

On hearing that **Harold Wilkins** and his wife (the former Marian Andrews, M.I.T. '31) had made a real visit to Iceland last summer, I begged for a story. Harold kindly sent what follows, and credits it to Marian: "Why would anyone want to go to Iceland? That's what everybody asked when we told them where we were going. We have always particularly enjoyed the northern countries and we were not disappointed in Iceland, a delightful place with only 200,000 intelligent, handsome inhabitants. The scenery is spectacular, with volcanic mountains, glaciers, tremendous waterfalls out in the wilderness with no beer cans or hot-dog stands; in fact, no signs of human habitation as far as the eye can see. There are green valleys with grazing sheep and there are valleys covered with red and yellow mud

around hot springs shooting steam in all directions. The Icelanders make good use of this steam. The entire capital city of Reykjavik is heated by water pumped from springs ten miles outside the city. Swimming is a way of life in Iceland. The Atlantic Ocean is too cold, so all the towns have large outdoor pools filled with hot-spring water. We were told, and we believe it, that everybody swims all-year-round, even during snow storms. Of course lava is everywhere and it comes in assorted shapes and sizes. There are miles of flat fields of it covered with a gray moss which turns gold when it rains. There are huge fantastic formations creating wild desolate scenes. Sometimes the silence is almost oppressive. Iceland is an ornithologist's paradise. Thousands of water birds nest on the cliffs, around the lakes, and along the rivers. Salmon fishing also draws visitors from many countries. So much is unique in this little country. There are no trees but there is a reforestation program now, and they are experimenting with many species of evergreens. They completely skipped the railroad era—there are no trains and never have been. It is said that Icelanders jumped off their ponies' backs into airplanes. A well-run air-transportation system covers the island. At the moment there is no tipping but tourism is coming and you can rest assured that that nice custom will soon be a thing of the past. I am sure that Women's Lib would approve of the fact that the ladies do not take their husbands' names when they marry. They have to make some concessions on that score when they travel in other countries! They have 100 per cent literacy and the large modern schools are turned into hotels during the summer. We stayed in several of them. High-school boys and girls sweep the streets and take care of the lawns and flower beds in the parks and have a good time doing it. Reykjavik is a clean, up-to-date, sophisticated city with theaters, museums, an excellent college, an orchestra and even small-scale traffic jams. There are more Volkswagens per capita in Iceland than in any other country. Last but not least, it is fun to have the sun shining until midnight and everybody out enjoying it."

Leicester Hamilton, in a memo written last November, pointed out that a great many of us came to the Institute from the Boston area and from elsewhere in New England, but that our geographical distribution is now far wider. From the Alumni Association list of October 15, 1971, of 119 living members of the class, he has compiled the following account showing how many of us live in each state and foreign country: Massachusetts, 32; California and New York, 11 each; Connecticut and Florida, 8 each; New Jersey, 5; Pennsylvania, 4; District of Columbia, Ohio, Rhode Island and Virginia, 3 each; Hawaii, Illinois, Maine, Missouri, New Hampshire and Texas, 2 each; Colorado, Delaware, Georgia, Maryland, Minnesota, North Carolina, Oklahoma, Vermont and Washington, 1 each; Canada and Mexico, 2 each; and England, Germany and Hong Kong, 1 each.

A brief notice of the death of **Louis W. Currier** was included in the news of our

class in the *Technology Review* for October/November, 1970. In August, 1971, Mrs. Currier sent a reprint of a memorial to him which appeared in *The American Mineralogist* for March-April, 1971. After an account of Louis' distinguished career, the memorial concludes: "Louis Currier was a long-time Fellow of the Mineralogical Society of America and the Geological Society of America, and also was a member of the American Association for the Advancement of Science, and many other professional societies. For 24 years he represented the U.S.G.S. on the Committee on Natural Building Stones, American Society for Testing and Materials, and he was its chairman from 1948 to 1960.

"Many of Lou Currier's emotional roots lay in New England, but he also was irrevocably wedded to dramatics. A participant, director, and one-time president of the Syracuse Drama League and Little Theatre, he later became active in the Washington Drama Guild and the Washington Civic Theatre. But it was as chief impresario of the Geological Survey's famous Pick and Hammer Shows that he made his greatest contributions to the enjoyment of others.

"Lou was an extraordinarily kind man, with a sensitivity to others that he often tried unsuccessfully to conceal beneath a stern visage. His undeviating devotion to his family and friends was all but incredible, and it left its mark on everyone who really knew him. His health was less than good for many years, yet he never allowed this to blight his efforts or his humor. He was a man of quiet purpose and courage, and one must conclude that his resilience somehow stemmed from his ability to kid his own way out of many depressing situations. Whether one best remembers Lou as a delightfully posturing thespian, a connoisseur of cigars and New England seafood, a skillful writer and a penetrating and humorous critic, a potent advocate in a geologic argument, or a sensitive and understanding friend, the image reveals a top-quality human being. Lou's creed was 'to so live that no one would ever be the worse for having known him,' and he made it stand up for the full term. Dr. Currier is survived by his wife, Evelyn Richardson Currier; a daughter, Mrs. Warren Preisser of Annapolis, Md.; a son, Wade R. Currier of Pitman, N.J.; two brothers, seven grandchildren, and four great-grandchildren." At the end of this memorial is a list of 28 publications of which Louis was an author.

New addresses: Mrs. Paul S. Howes, Box 306AA, Berkshire Ave., Southwick, Mass. 01077; Thomas W. Sheehan, 78th St., Harbor Way, Newburyport, Mass. 01950; Robert C. Wiseman, Box 341, Bedford, N.Y. 10506.—**Charles H. Chatfield**, Secretary, 177 Steele Rd., West Hartford, Conn. 06119

15

They're off! The annual trek of our Northern snowbirds is on as they leave for the alleged sunshine of Florida. We don't blame them, for the first snowstorm of the winter here last night (the

night before Thanksgiving) has left everything covered with a cold wet slush. **Whit Brown** to Anna Maria, Fla.; **Charlie Calder**, St. Petersburg; **Jack Dalton**, Winter Park; **Harvey Daniels**, Delray Beach; **Larry Landers**, Hollywood; **Boots Malone**, Umatilla (that's in Florida, too). . . . On top of these **Hank Marion** has retired to Imperial Terrace Apartments, 2525 N.W. 62 St. #109, Oklahoma City, Okla. 73112; Virginia and he will spend the winter, as usual, in Tucson. **Frank Murphy** to 65 Angelo Lane, St. Augustine Shores, Fla. 32084. I hope some of you fellows driving in the South will see some of our classmates down there. . . . **Larry Bailey** and his son, Bob 41, sailed from Boston on November 20 on the new "QE-2" for a Bermuda cruise. . . . **Sol Schneider** wrote that he was enjoying a fine cruise on a fine ship. So just to keep up with all these trippers, Fran and I hope to sail on the *Europa* in February for a cruise in the Islands. To silence my perennial naggers, led by Bill Brackett, Alton Cook, Ben Neal and Jim Tobey, I announce that the class treasury is in good shape to permit my doing this. Ha! ha!

Reporting our Boston Class luncheon in last month's column I neglected to give credit to **Bill Brackett** for his gift of a ball-point pen to each of us and Larry Bailey's generous supply of "Life Savers." Larry designed the machines that make the holes in these little candies. . . . There will be another class luncheon at the M.I.T. Faculty Club, Cambridge, on Friday, April 21. We hope some of the New York and Philadelphia boys will come up for this.

Jerry Coldwell, as chairman of the Building Committee of Roosevelt Hospital in New York is busy with a multi-million dollar program of additions and extensions to that famous place. Good work, Jerry—keep it up!

Well, this old age of ours takes its toll, so it came my turn to land in a Boston hospital the end of October. The thoughtful Pirate notified some of the fellows on our Boston and New York mailing lists and I wish you could see the deluge of cards and messages these wonderful guys sent me. In addition, there were several pleasant visits at the hospital and when I returned home (including a pleasant hour with Jack Dalton, now recovered from his recent troubles) and many phone calls. And long distance calls from Jerry Coldwell, New York; Wayne Bradley, Moosup, Conn.; Jack Dalton and Pop Wood, Peterboro, N.H.; John Dalton, Providence; Charlie Norton, Martha's Vineyard; Ben Neal, Lockport, N.Y.; Hank Marion, Oklahoma City; Frank Murphy, St. Augustine, Fla.; Lucy and Harry Murphy, Hingham; Max Woythaler, Framingham and Sam Berke, Lakeville, Conn. Then sons of the Class wrote me—Bob Bailey '41, David Hamburg; John Lacy '42 and Bill Sheils. All this touched me deeply, really. It was so reassuring, comforting and cheerful. I simply didn't have the "steam" to acknowledge or answer each of you, but I certainly want you to know I sincerely appreciate your friendly interest and concern. You're a great bunch of friends. I'm proud of my classmates. I'm very fond of my classmates.

Many thanks, many blessings to you all.
—**Azel W. Mack**, Class Secretary, 100 Memorial Dr., Cambridge, Mass. 02142

16

Here we go again. And we surely appreciate all the fine responses we get on our requests for bits of news and philosophy. It won't be long now before we'll be writing about the timing of our 56th reunion, to be held in good old Chatham Bars Inn, Chatham, Cape Cod. Our attempts at stick-man art in personal birthday cards brought cheerful responses from Clint Carpenter, Larry Knowlton, Mac McCarthy, Allen Pettie and Will Wyde.

We can't help but say we'll wager that not many classes have such good coed classmates as we. Our **Elsa Mueser** of Mountain Lakes, N.J., wrote late in November, "We are off to Maine by air for Thanksgiving to visit daughter Sylvia and husband plus boys and girls in a house (of 80 tons) that has just been moved across the waters." In reference to questionnaire items, she comments: "(1) used to mix up chemicals, now bake ten kinds of bread, plus four kinds of cookies to give away; (2) rake leaves; (3) happily watch children and grandchildren develop better than we ever did." Then, how about this frosting on her cake: "Never could you have class officers as good, reliable and inventive as those in 1916. I love all of you!" . . . We regret that, due to illness, **Howard Claussen** has had to resign his many activities. He writes that his attorney son, who attended a reunion or two with him on the Cape, is register of probate, and lives with them at home in Cotuit. He was appointed register by Governor Sargent, "then re-elected on his own and is a politician par excellence—has so many speaking dates he will wear himself out." . . . **Rudi Gruber**, a three-time visitor to Europe this year so far, says that "the outstanding visit was in June when my kinfolk celebrated my 80th birthday at Landau on Lake Constance. Almost 60 members showed up for a two-day celebration. As a member of the M.I.T. Corporation Development Committee I get to Cambridge frequently and enjoy my contact with M.I.T. personnel and leading graduates. The recent M.I.T. 'Evening at the Met' in New York was a great success. This Christmas I shall celebrate in Germany with my one remaining brother. Here is wishing you good health and Auf Wiedersehen!"

Miriam and **Merrick Monroe** are enjoying their relatively new status as Grandma and Grandpop as their son, now a doctor in California, and wife and 13-month-old, flew back from Los Angeles to Maine in early October for a week's visit with them in the fall beauties of the Maine woods. Merrick compares the cost of such a trip with what his costs were way back at the turn of the century. He says: "When I was a kid, my father might give me 50 cents to be spent as follows—20 cents round-trip to Boston via trolley car, 25 cents for a seat in the bleachers to see the Red Sox play at Fenway Park, five cents for popcorn. Times is changed!" . . . Writes Dr. **Paul**

Duff: "Disability comes with age and we have to adjust. I am not as active in my practice as I have been. Roderick took us on a trip to Quebec, the White Mountains of New Hampshire and the Green Mountains of Vermont. We were in the midst of and closer to more autumn color than ever before. The change in seasons reminds us that we are enjoying our small experience in the eternal rhythm!"

The luncheons attended by '16ers and '17ers who happen to be near New York on the first Thursdays (after the first Mondays) of the month continue to flourish at the Chemists' Club, 52 East 41st St. In October, **Jo Barker**, **Herb Mendelson** and **Rudy Gruber** represented the class and **Bob Burnap** writes to explain his absence: "I would like to join the group at the Chemists' Club on the seventh, but unfortunately, I have another appointment for that afternoon. Perhaps I can make it in November. As usual in recent years, news for the class notes is very scarce. Katherine and I stay reasonably healthy. During the summer, I get my exercise by taking care of the lawn and the shrubbery and encouraging the roses and other flowers to grow in our back yard. We both manage to do a lot of reading; mine covers the waterfront, technical, financial, some fictional, and some just plain hobby interests. Altogether, life isn't too bad even if not very interesting."

For an illustration of "The best laid plans . . ." and "All's well that ends well" perhaps you've noted the article about the new all-weather tennis court "blimp" provided for M.I.T. by **Jap Carr** and family. It appeared in the October/November issue of the *Review*, page 93.

A letter from **Bill Drummey** dated July 8 and sent to Jim Evans comes to light a bit late but still in time for these notes: "I had more than a hunch and a bit of flu, when I told Bob O'Brien, I thought I should not go to the Cape for reunion. I am a week or so back from the Mass. General Hospital—loss of more than 50 per cent of my blood, internally, from inside bleeding by a duodenal ulcer. All happily replaced. On a diet, of course, including no booze!—for an extended period—else curtains. I obey. Had two offers: (1) sitting on a damp cloud, bare tail, playing a harp (not quite up to biblical advertisements) or (2) third assistant Devil in charge of stuffed shirt department. While I was negotiating, offers were withdrawn. Well, I wanted to, but think these were sufficient reasons not to."

A post card from **John Fairfield** was forwarded to us from Jim thanking him for his resume of the reunion and "evidence that you also survive. Keep it that way. Went to Blue Mountain Lake and the Adirondack Museum, one of **Walt Binger's** interests where his name is on a brass plaque. It is an excellent museum. Our garden and the countryside in general is gorgeous so we enjoy the sights." . . . **Ed Graustein** writes of the travails of one of us who is still working, "Since our Reunion at Chatham Bars I have been disconcerted and delayed by a dust storm in my office which developed when the open fireplace and connecting brick chimney were removed in a general re-

construction program of the entire building. The owners are all Tech men, I believe, and specialize in structural engineering of all varieties. The fireplace happens to be in the rear of my office-space and unbelievable amounts of dust came down with the chimney. Everyone suffered for months. Now all is well again and in my spare time I found out how to use my new aluminum shafted woods. Next year I am sure I can use the irons as well. My book now concerns Asia, the wet monsoon of India, the Japan current and the hurricanes of the Indian Ocean which have two separate seasons north of the equator and the typhoon of the north tropic of the Pacific itself. When this is done I will start assembling the whole study (God willing)."

From Charlottesville, Va., a good letter from **George Maverick** attests to happy goings-on: "Such an uneventful, healthy and beautiful summer at Shepherds Hill Farm that I can't come up with anything bad enough to qualify as news. In June I flew to San Antonio for 'A Maverick Fiesta' a get-together of about 150 of my mother's and father's descendants. It was a wonderful group and party. It sort of reassured me of our country's vitality and health—despite the news media! Next week there'll be a very formal church wedding of a grandson. A far cry from mine in 1917—that has improved over the years. As the first coupling among the seven grandsons (legal and non-trial), we are really thrilled. Lots of coming and going at the farm keeps us from yearning too much for Mexico or Greece. But snow may drive us away. Is it good that the fires burn low?"

A letter to Jim Evans from **Arvin Page** has been forwarded to explain his missing our 55th: "Many thanks for the souvenir flag and ballpoint you sent us, one is useful, the other isn't. It does hurt my conscience to use the pen as I feel I did nothing to deserve it. And besides, it reminds me of the clambake I missed by non-attendance. I could not figure out how to make the trip to Chatham as you suggested." . . . Clippings have been sent to us from the Alumni Office relative to **Van Bush's** activities. An article from the *New York Times* of August 1, "The Electronic Computer's Inventors," states "In 1930 the first general purpose computer was built at M.I.T. under his direction" and gives a brief summary of its functions in another paragraph. Another is a most interesting interview with Van by the Director of the National Science Foundation, William D. McElroy and we infer that it was published in a recent issue of their magazine, *Mosaic*.

Several notes in connection with the Alumni Fund drive were forwarded from Cambridge. **Ralph Mills** notes of his continuing interest in "astronomy and telescope making, traveling in the southwest desert and Indian country." . . . **Ken Sully** writes: "After our 55th Class Reunion at Chatham Bars we visited friends and relatives in New York, Toronto, London, Winnipeg, Brandon and Vancouver returning home July 1. We were happy to have recently had a visit by Charles H. Lawrance, '42, son of our own classmate Charley Lawrance whom

we were glad to see at the Reunion in June." . . . **Willard Brown** noted with satisfaction that the coed who had done most of the work of the M.I.T. Club of Southern California is now president of the club.

Again, we quite enjoy all the bits of mail that come from all over the country. So write us often even if only a little—anything that comes to mind and keep your willing-to-work secretaries busy.—**Harold F. Dodge**, Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; **Leonard Stone**, Assistant Secretary, 34-16 85th St. Jackson Heights, N.Y. 11372

17

News of classmates is scarcer this month than it ever has been. By the time you read this you will have had a letter from Al Lunn regarding our 55th reunion and urging you to come. Al, Tubby Strout, Brick Dunham and your secretary sat in on a planning meeting in November—things are under control. Besides Al's letter, a "Reunion News" will reach you in February so you will be well informed. It will list the names of those who have indicated their intention to come, so if you have not returned your card do it now.

We were able at a recent Council Meeting to get a preview of plans for the campus Homecoming, June 4 and 5. The big thing on Sunday is the "Pops" at Symphony Hall. It will again be a sell-out M.I.T. night. For Monday really unusual events are lined up on campus. So make your plans to include Cambridge and then on to the Cape.

Penn Brooks didn't make that October trip to France but he was getting away to Davos, Switzerland with son Bob and family for skiing over the holidays, even if Penn doesn't ski. . . . Happily, **Al Moody** has recovered nicely from brain surgery last July. He had gone to Kansas City on a six-month job to add to a refinery of the American Oil Co. Stricken there he was able to get home to Denver for diagnosis and surgery. Now he is performing his regular activities. . . . Some have thought that **Bob Erb** was the Class Baby. Others thought it was **Dick Loengard**. According to the record Bob is the winner: March 17, 1897 versus Dick on January 2, 1897. Congratulations to the two youngsters as they reach the three-quarter-century mark which makes all of us old timers.

If you want a tongue-twister just think of **Dave Waite** at Quonochontaug, R.I. The Waites celebrated their 50th wedding anniversary by a Caribbean cruise. . . . **Frank Peacock** years ago was chief engineer of the Woodward Governor Co., Rockford, Ill. Last June they asked him to help out, as a consultant. He is working three days a week which is all he wants. Frank should have been at Northfield and check on the Woodward governors at the pumped storage plant.

Regretfully the death of **Lucius T. Hill** is recorded. He was a life-long resident of Brookline, Mass., where he had been active in civic affairs. He attended Andover Academy and in World War I commanded a trench mortar battalion in

France. Active in the investment business he had been treasurer of Eastern Utilities Associates and president and subsequent chairman of the Fall River Electric Light Co. He had been a trustee of Peter Bent Brigham Hospital, a director of the Boston Lying-in Hospital, the Suffolk Franklin Savings Bank and Mt. Auburn Cemetery. He was a member of The Country Club, past president of the Grand National Curling Club and past commodore of the Beverly Yacht Club, Marion, Mass. Loosh was a man of warmth and graciousness, a man of high intellect, high standards and capabilities. His entertaining and revealing treasurer's reports over the span of years he served as class treasurer bespoke his rare sense of humor. We are better for having known him. The memorial service was attended by Susan Lunn, Tubby Strout, Marion and Les Ford, Doris and Bill Hunter, Jeanette and Stan Dunning.—**Stanley C. Dunning**, Secretary, 6 Jason St., Arlington, Mass. 02174; **Richard O. Loengard**, Assistant Secretary, 21 East 87th St., New York, N.Y. 10028

18

From time to time, I become involved in programs at M.I.T. which give me an insight into the broad scope of its activities. On November 16, 1971, I was a participant in the "1971 New England Executive's Conference" sponsored by the M.I.T. associates. This all-day meeting included five working seminars to study the future demands on New England to meet the problems for the balance of this century, particularly, those industries oriented to defense markets and space programs. About 200 senior executives, engineers and scientists from this area attended this conference. The panelists included many of the important leaders from industry and from the M.I.T. community. It was a most interesting and exciting conference. I wish it were possible for each of you to become involved in one or more of these directions in which M.I.T. is actively helping to meet the challenges of the larger community, for its peaceful growth.

Now, as to news notes from the classmates, thanks to Len Levine, we have this note from **Nat Krass**. "I am sorry to tell you that my wife Betty passed away this fall and I am alone but will continue to live at the same apartment. I would be very happy to have you and Gladys come down and spend a few days with me. I am sure we would all have a good time. My eyes continue to get worse. I have great difficulty in reading but the doctors tell me I will always have some vision. This is a hopeful note but it takes some adjusting.

"My daughter Stephanie is living in Pittsburgh where she is married to a city planner and has two children—a boy three years old and a girl of one year. My son Jonathan is a stockbroker in Palo Alto, Calif. I went to an M.I.T. luncheon and heard Howard Samuels speak. It was a great talk. I sat next to Tom Bresnahan and we had a nice visit. Best regards." Our sympathy goes out to him for the loss of his wife, Betty.

In addition, Len Levine sends a re-

view of Nat's career: "For years, I have unsuccessfully tried to have Nat Krass write about one of the high spots of his career, i.e., how he used a sound engineering technique to expand a small, moderately successful business into a large, extremely profitable one. I am therefore taking the liberty of submitting this unusual and interesting story. After trying engineering for a few years Nat decided it was not for him. He then joined a small company in New York City making men's conventional clothing in many styles and colors. Every six months, styles, colors and fabrics had to be changed. Nat soon noted how difficult it was to eliminate leftovers and mark-downs and to meet the competition of hundreds of other manufacturers making the identical items. Profits were relatively small. Using his uncanny instinct, Nat conceived the idea of specializing in the production of a fine blue serge suit (popular at that time), moderately priced, carry-in stock 12 months a year, for immediate delivery in the latest models for men of all sizes. This new idea simplified production problems, improved deliveries, eliminated mark-downs and allowed better mark-up. Retail stores showed great interest and hundreds of new fine accounts were opened from coast to coast. Later, suits in gray and brown were introduced with similar success. The company became very successful and Nat was taken in as a partner. As a result, he was able to retire very comfortably at 50 when most of us were still trying to make it. Moral: A good M.I.T. training and education can be of great help in any industry. P.S.—I am quite familiar with above as I was connected with Nat's company for ten years as salesman and sales manager."

Dick Holmgren, '19, sent this note along with news of the death of **Carl S. Helrich**. "He and I graduated in 1920 because of the war. I stayed with my class of 1919 and I believe Sam stayed with Class of 1918. It was quite a blow to all of us to hear of Sam's death. We had been trying to get together for seven years and had decided on 1972. Now that is impossible." The clipping stated that Mr. Helrich, born in Everett, Mass., graduated from M.I.T. with a degree in civil engineering and came to Oak Ridge, Tenn. in 1943. He became one of the city's most prominent civil engineers and construction officials, responsible for the building of many schools, homes, and plants in the area. His career in Oak Ridge began as project manager for the John A. Johnson and Sons, construction company, and then when the company left in 1952 he formed his own construction company. Mr. Helrich loved to keep fit by regular walks and hiking. He is survived by his wife Anna, a daughter, a son and a grandson.

Thanks to Len Levine, here is a note from **Herbert Goldsmith**, Tucson, Ariz. (I suggest that he contact Ed Rossman, 7860 E. Hampton, Tucson) "Dear Len: Answering your letter requesting the high spots of my career since I left M.I.T., there have been too many to relate in 200 words, but I'll try to tell some. When World War I came around, I let my patriotism overcome my better

judgment and dropped out of Tech (instead of staying put and getting my degree in mining and metallurgy) and enlisted in the army spending 18 months overseas until the end of the war. When I returned, I figured it was too late to get back into harness at Tech so I entered the firm of Goldsmith Brothers S and R Co. of Chicago (a 100-year-old firm) specializing in the smelting and refining of precious metals and lead and the production of silver nitrate. I remained with this firm for 40 years until we became a division of National Lead Co. when I retired and moved to Tucson, Ariz., where I have been living ever since."

Two other inquiries from Len Levine to classmates came back with news of their deaths. We send our sympathies to the families. Norma (Mrs. **Samuel**) **Rubin** wrote telling of the death of her husband: "I am replying to your letter as Sam died a month ago. I am his second wife. We met only six years ago—he a widower and I a widow. I would love to tell you about his brilliant career, but only know the high spots. He had a career in the U.S. Army from 1918-1945, retiring as a full colonel. He then joined the faculty of U.S.C. and headed his department in transportation. He had many honors in California, one, I recall, when the Governor appointed him to the library commission, and another, when Sam and the president of U.S.C. had a TV program every Sunday evening. He was an advisor to railroads and so it went. He retired from U.S.C. due to severe illness of his wife and was writing a book on transportation economics. I have the manuscript as he became too ill to see the publishers. I also have his library here in Brooklyn. I would love to give his books to M.I.T. but it is too difficult to transport them. I have always been proud of Sam and seeing him decline was a real agony. At least he is now at peace."

From Mrs. **Albert F. Sawyer**: "Your letter to Albert came a couple of months ago. I am sorry to report that Albert passed away September 2. It was quite sudden—though he had emphysema he seemed to be getting along remarkably well, but his heart gave out. The M.I.T. class of 1918 has been notified. He was always so interested in all his classmates and had plans to attend the reunion. I remember well the 50th, and he enjoyed it so much." . . . We also received news that **Ralph Crosby** of Westfield, Mass., passed away July 31, 1971.

On a more cheerful note, we have a note from **Ted Braaten** indicating that he will leave this area in 1972 for a three-month trip to Japan, Korea, Formosa and Hong Kong. . . . Our eagle-eyed Len Levine noted in the *New York Times* on November 26, that the Agency for International Development has given M.I.T. a grant of \$900,000 for a five-year "Interdisciplinary" program that will start building an understanding of what kinds of technology can usefully be imported by developing countries. And, perhaps more importantly, how it is to be done. . . . A card from **Granny Smith** covers a year of much travel, including New England, Canada, Portugal, Holland

and Denmark. He notes that B. Alden Thresher will be his guest in late January.

New addresses: Charles E. Dimock, 27 Jackson St. Ext. 3rd Fl, Methuen, Mass. 01844; Sidney B. Blaisdell, Apt. 401 Royal Bonnet Ct. Shell Pt. Village, Ft. Myers, Fla. 33901; Giles D. Hulsemann, C-102 Lake Latawana, Lees Summit, Mo. 64063.

Since writing these notes we learn with sadness of the death of John Markham. He was with us at our mini-reunion in October and we enjoyed this contact with him. The *New York Times* reports: "**John R. Markham**, professor emeritus of aeronautical engineering at M.I.T., a leading authority on wind tunnels, died December 12, 1971. Professor Markham, who was injured in a fall last month, was 76 years old and lived in Belmont. He enrolled at M.I.T. in 1914 but left in 1917 to serve as a captain with the American Expeditionary Force. He later directed the construction of M.I.T.'s Wright Brothers Wind Tunnel and during World War II supervised testing at that tunnel of virtually all U.S. warplanes. He also directed the design of M.I.T.'s Naval Supersonic Laboratory with its Mach 3 wind tunnel and a wind tunnel for Boeing that was used in developing early jet liners. He was named an assistant professor in 1930, an associate professor in 1940 and a full professor in 1947. Surviving are his widow, the former Genevieve Triquera, and two sisters."

Your Secretary has been receiving much news from **John Abrams** concerning his battle to preserve a reasonable pollution-free atmosphere in the high Sierra in California. Much luck to him in this fight.—**Max Seltzer**, Secretary, 60 Longwood Ave., Brookline, Mass. 02146; **Leonard Levine**, Assistant Secretary, 519 Washington St., Brookline, Mass., 02146

19

Richard Holmgren from San Marcos, Calif., writes "We are now comfortably settled in our new model home in a beautiful park with all conveniences including a beautiful recreation room, sauna bath, jacuzzi bath and heated pool. We still have our Airstream travel trailer and just returned from a six-week trip on Vancouver Island, B.C.—Great country." . . . **Dan Hall** had a cataract removed from his right eye in September, so we had a note from his wife.

The New England newsclip had an item on September 18, 1971 announcing the death of **Samuel A. Brunelle**, 75, vice principal of Holyoke High School until 1964, on September 15 following a short illness. . . . **Leon H. A. Weaver** passed away in Cape May, N.J., August 1, 1971. . . . **Charles E. Little** passed away on June 4, 1971 in Melrose, Mass.

A note from **Lloyd R. Sorenson** states he and Winnie spent the summer golfing, fishing and farming at their summer home in Yorktown, Va. This was after a four-month assignment in Cartagena, Colombia, S.A. as a volunteer executive in a shipbuilding company for I.E.S.C. . . . Among the M.I.T. President's Inauguration List of Registrants were Ben Bristol,

Larry Riegel and Paul Sheeline. . . . The class of 1919 contributed \$14,400 to the 1970-71 Alumni Fund with 92 contributors. . . . **Paul Sheeline** and **Ben Bristol** attended a social gathering at the Endicott House in Dedham with the class of 1918 on October 17 and are planning on a similar party each year for the classes of 1917, 1918, and 1919. President and Mrs. Jerome Wiesner were guests at this meeting.

A note from Grace and **Ren Smith** tells about attending the wedding of the daughter of Al Kruse, '20, in Wilmington, Del. and about Al and Bud Fisher, '18, leaning on canes for support. . . . **Nellie Bond** writes from Washington, D.C. that he spent Thanksgiving with his son in Schenectady, N.Y. and witnessed the fall of two feet of snow on Thursday and Friday. He will spend Christmas there.

Some address changes of our classmates follow: Alan G. Richards, 1710 Elevado Ave., Arcadia, Calif., Morris P. Berk, 70 Park St., Brookline, Mass.—**E. R. Smoley**, Secretary, 50 East Road, Delray Beach, Fla. 33444

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The annual trek to the sunny south has been taking place as usual. Barbara and **Bill Dewey** are cozily ensconced in the Capri Apartments, 325 Capri Blvd., Treasure Island, Fla. . . . Ruth and **Bob Bradley** are at Delray Beach along with Kay and **Pete Lavedan**. . . . Beth and **Ed Ryer** have gone back to their favorite Naples, Fla. . . . Billie and **Dick Gee** are in Davie, Fla., at 6505 W. 49 St. . . . **Andy Johnson** is in Sarasota and so is **Herman Marrow** who busies himself working for the Sarasota Memorial Hospital and goes golfing and fishing in his spare time. . . . **Scotty Wells** is in Clearwater and plays golf at a three-par course which he describes as "a Florida invention for older people." . . . Margaret and **Skeetz Brown** are back at their attractive ranch home in Scottsdale, Ariz. . . . California-bound are **Bill Nelson** who hangs out at 360 Golden Oak Dr., Portola Valley and your secretary and his Amy who spent Christmas and New Year's in Belvedere, near their daughter's family. . . . Captain **Russell Hitchcock** has moved from Sheepscot to Farmington Falls, Maine.

Ed Howard of Lexington, Ill., writes that he has been in poor health all year but is now able to be up and about. We all wish you a full recovery, Ed. . . . Florence and **Lee Thomas** are back in Wynnewood, Pa., from a trip to England, France, Germany, Holland and Spain. Always on the go, that very nice couple, indeed. . . . A card from Elvira and "**Toots**" **Kinghorn** gives the word that they remain in comfortable retirement at their home in 200 Glenwood Circle, Monterey, Calif. . . . Ilse and **Chuck Reed** enjoyed a Thanksgiving visit with their son Edwin, '45, in Houston, Texas. They have three Texas grandchildren, two girls, both in college, and a boy in high school. Chuck is entitled to be justly proud of the million dollar Charles H. Reed laboratory which was recently dedicated.

The years 1920-1972—it appears appropriate to issue each and every one of

you who read these few notes heartfelt congratulations at having survived this era of two world wars and the deepest of depressions, not to mention the mental and moral depression of the late years. Having observed at first hand a sizable cross-section of the Class at our 50th, I am able to predict that we shall continue to face whatever is in store for us with undiminished cheerfulness and courage, regretful only that we may not find it possible to participate more fully in the exciting turn-of-the century advances of science, medicine, astronomy and ecology. I wish you all a year of good health and good spirits. And, please, make it your good resolve to keep in touch with your hardy perennial secretary.—**Harold Bugbee**, 21 Everell Rd., Winchester, Mass. 01890

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A small item in the October/November 1971 class notes told about color photos taken by **Laurence Buckner** at reunion. Plans are afoot to mount these beautiful, clear pictures of about 60 couples on a back board to be reproduced as an 11-by-14-inch print. Cost: about \$4 per print for 25 orders and only \$2.65 if 50 orders are received. Bob Miller invites others not photographed "to have a close-up head and shoulders horizontal 35 mm color slide made with a plain background" and mailed to him. . . . **Munroe Hawes** also took three color photos of the class in sections on the Sloan Building steps. Some classmates were not in the pictures but the enlarged prints are superb. Cost: about the same as the Buckner pictures. Write **Robert F. Miller**, 3386 Chiswick Ct., Silver Spring, Md. 20906 to order either or both of above.

A much appreciated letter from **Garvin Bawden**, Duxbury, Mass., related that **John W. Barriger**, C.E.O. of the Boston and Maine Railroad was the guest of honor and featured speaker at a meeting of the Newcomen Society last May in Boston. Mich Bawden said that John gave a wonderful, knowledgeable talk on railroads entitled "What Next?" John and Elizabeth Barriger attended our 50th Reunion but John disappeared that first Sunday in June to go to the scene of a freight wreck on the B. and M. We have yet to learn whether he wore his red blazer to the scene.

Cac Clarke reported that he and Maxine stayed overnight with Ruth and **Irving Jakobson** late in July. Their stay included a day of sailing on Long Island Sound and dinner at the yacht club to which Irving and **Ray Cooper** and Jane and **Dayton Brown** were invited. All three men wore their red blazers. . . . The Irving Jakobsons, Ray Coopers and your secretary attended the gala M.I.T. Evening at the Metropolitan Museum of Art in New York on November 4, at which President Wiesner gave the main address. He discussed the relevance and future of the arts at M.I.T. A tour of the exhibitions and much sociability made this a very memorable evening. . . . Last June's class notes, reported on **Alan L. Morse's** 50 years flying experiences starting with a "Rubber Monster" and

correspondence was invited which brought forth a reply from **Frederic J. Grant**, P.O. Box 606, Ojai, Calif. 93023. Fred said in part, "I hold spherical balloon pilot license number 95, issued in 1917. I was one of the first two cadets to enter the U.S. Balloon School at Fort Omaha, Neb., was commissioned as first lieutenant; went to France and was ordered to the front on the Toul Sector on February 26, 1918." His was "the first unit of the American Air Service in action against an enemy on foreign soil; ordered to Chateau Thierry in June and participated in the Aisne Marne drive." Later he was ordered to the Balloon School at Souge and appointed director of instruction with the rank of Captain, Air Service; he returned from France in 1919. Thanks for a most interesting letter, Fred.

Albert E. Fowler, Jr., of Somerville, N.J., was the author of a short story in the spring 1970 issue of *The New England Galaxy*, published by Old Sturbridge Village. Titled "The British Are Coming," this stirring account of an episode in the Revolution described the panic in Newburyport right after the battle of Lexington and Concord. Shortly, confidence returned when a rousing sermon in the Presbyterian Church the following Sunday ended with 30 volunteer enlistments and standing cheers from the entire congregation. Al and Helen Fowler had lunch with the Haywards in Ridgewood on a mid-November day and your Secretary learned that the Fowlers and their son Richard (M.I.T. '49) will probably move to Denver, Colo., next summer when Johns Manville moves its research headquarters. Al is hoping to get a radio spot in Denver similar to one he had years ago when, as the "Yankee Philosopher," he had a 15-minute weekly spot on which he read poetry and told Yankee tales.

A note from Alex Tuthill, Grand Rapids Mich., told of **Howard Tuthill's** bout with surgery in the summer of 1969. He made a good recovery, still works part-time, but did not feel up to coming to the 50th last June. The Tuthills spent the summer at their cottage on Lake Michigan, just south of Grand Haven. Their daughter, Diane was married in late June to James M. Zarafonetis of Peoria, Ill. . . . George Chutter and our class President Irving Jakobson reported our class was well represented at President Wiesner's inauguration last October 7. Oliver Bardes, Edouard Dubé, Mel Jenney, Leila and Sam Lunden, Bob Miller, Bill Sherry and Ted Steffian attended various sessions that day. The Lundens flew back to Los Angeles following the inauguration. The night before, Helen and **Bob Miller** were hosts at a pot-luck supper at their cottage on Cape Cod. Present were the Percival Crockers, the George Chutters, the Al Lloyds, the Sam Lundens, the Don McGuires and the Whitney Wetherells. Reports George Chutter "a delightful evening."

A Small Business Administration news release states that Colonel **Asher Z. Cohen** of Baltimore, Md., was designated as delegate to the 1971 National Conference of the Service Corps of Retired Executives (S.C.O.R.E.) held in Seattle,

Wash., October 13-15. Asher, along with thousands of retired businessmen in S.C.O.R.E. chapters across the country, regularly gives of his time and business experience to the cause of counseling small businessmen. . . . Last month a brief mention was made of **Saul Silversteins's** safari number-32 take-off on September 6, to visit South America. This was to be a 45-day combined business and pleasure trip. He has sent a very interesting account of his trip commenting on the various countries, living conditions, etc. Saul now has two new directorships on the boards of Rolls Print, Calcutta, India and Niffon Mektron, Tokyo, Japan. Safari number-33 to Cyprus, Turkey, Israel, India, Japan, Korea and Hong Kong began on November 5, 1971. . . . The Tuscaloosa, Ala., news reported that **James R. Cudworth** harbored the most memories at the Golden Anniversary on May 26, 1971 of the Tuscaloosa Metallurgy Research Laboratory, U.S. Bureau of Mines. Jim retired as Dean of the College of Engineering, University of Alabama, in 1968. The article added that the mineral industries, particularly coal, have been a "passionate concern of his over the past 48 years. Few persons have contributed more to professional interest, research and development in this field than Cudworth." He and his wife attended our reunion last June.

Maxine and **Cac Clarke** reported a trip in October to spend several days with Maida and **Ed Dubé** at their home in Reading, Mass. The quartet drove to various areas to enjoy the fall foliage in New England. They visited Strawberry Banke in Portsmouth, N.H., and saw many of the reconstructed homes and buildings on the old harbor site of "Puddle Dock." Ed still maintains his consulting engineering office in Boston but on a less demanding schedule. He leads the housing and development commission in Reading. Three of the four Dubé children and their families live within walking distance of Ed and Maida. On the way back to Brielle, the Clarkes stayed overnight with Helen St. Laurent in Manchester, Conn. Maxine is continuing to have more one-man shows and her pictures were on display in four towns during Art Week. . . . A letter from Reverend Dr. **Williston Wirt** of Claremont, Calif., told of his phoning your secretary's sister in a neighboring California town after reunion. Interestingly enough this sister remembered Will's father who was an associate minister in Campello, Mass., when Will was in grammar school. Another bit of news in Will's letter was that George Chutter and he lived in the same dormitory at Kimball Union Academy.

Sadly we report a number of deaths in the class and extend our deep sympathy to their families: **Roy B. Chase**, November 13, 1971; **William R. Ferguson**, November 3, 1971; **Leroy M. Hersum**, November 26, 1971; **C. Harry R. Johnson**, November 22, 1971; **Ivan C. Lawrence**, August 18, 1971; **Thomas W. Proctor**, November 6, 1971. We are glad that both Roy Hersum and Harry Johnson and their wives made it to our 50th. Thanks go to Dug Jackson and Ed Dubé for

supplying information.

Because of the unexpectedly large turnout at our 50th Reunion, a treasury surplus of about 10 per cent of reunion funds resulted. Most attendees chose to have this given to the Alumni Fund in memory of Raymond A. St. Laurent. This has been done and Helen St. Laurent asked your secretary to extend her thanks to the class members. She is also most grateful for all the letters. . . . Gertrude Junod also wrote "please convey to the 1921 Class my many thanks for their sympathy and thoughts of us."—**Sumner Hayward**, Secretary, 224 Richards Rd., Ridgewood, N.J. 07450

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Your secretary is always confused with details at the end of each calendar year and 1971 is no exception. We found in our Class of '22 files many items of our 45th Reunion including a long list of reservations at the Wianno Club on the Cape with programs for fun and frolic, the prize winners in active sports, plus the most grandchildren, and the exciting events at the Institute Alumni Day on Monday, June 12. At M.I.T. we heard that "the University is man's invention" and how the development of science and engineering affects our lives. It was probably Dr. Jerome B. Wiesner who said "getting an education at M.I.T. is like drinking from a fire hose." We were also asked if the textbook is the best way to get information to the student. Provost Wiesner felt that working for the government was "like steering a car with a rubber hose." . . . What we are leading up to is our 50th Reunion next June. Are you ready? Regarding the Alumni Fund Class Gift, a note from **Dale Spoor**, Class Agent, is very encouraging. He says that nearly two-thirds of the checks received to date were for double the usual contributions—so it appears that 1922 has accepted his challenge, and is well on the way for a new high gift to announce at the time of our reunion next June. In case you have not already contributed, or merely sent in the same amount, you may wish to join this parade of your classmates who are supporting M.I.T. so handsomely. In any event plan on being present for our 50th Reunion next June.

The Christmas Edition of Spoor's Travels have thrilled us with hopes for a similar experience after retirement. They enjoyed the round-the-world cruise on the S.S. *Rotterdam* covering South America, South Africa, India and Japan with many intermediate stops during this three-month trip. They have been at M.I.T. for several outstanding events, have driven to the West Coast with many side trips and spent October in Spain. Thank you Dale, for telling us about it. . . . The 1971 Christmas card from Carlys and **Frank Kurtz** indicates geographically their trip through the Mediterranean and Black Seas, to Rome, Munich and Berlin before sailing to New York and Florida on the *Hanseatic*. . . . **John Vaupel** of Boothbay Harbor, Maine, has written of his good summer, good weather, good sailing, good canoeing

and good parties while in the "boon-docks." The Vaupels headed south in November to drive around Virginia including Williamsburg, but are very happy to be back in Maine. John had visitors from Manchester-By-The Sea—Louise and **Ted Elliott**, but he is happier in the Muskie area. John has been elected to the board of trustees of the region school as they plan new buildings and a major expansion program. Their problem is that there are normally 1,600 inhabitants which swells to 40,000 in the summer. Between other activities, he has been doing engineering services for boat facilities in the area, and surveying and designing docks on a part-time basis. He attends the M.I.T. meetings at Holiday Inn in Portland. He will be sure to see us in June, ready for tennis, jogging, golf and night clubs.

John J. Cychol of Paris, Ill., has retired twice since 1964 and now, when he gets tired of doing nothing, he rests. . . . **Kenneth R. Sutherland** retired in 1967 from Sutherland-Abbott of Boston, an advertising firm. . . . We are delighted to hear that Dr. **John Streider** of Chestnut Hill, Mass., has been elected president of the American Association for Thoracic Surgery. Dr. **Leon S. Medalia** of Scituate has received a citation as founder of the Hebrew University of Jerusalem. He has also been honored recently by the Royal Society of Health of London as a Fellow. Leon has just finished writing a book, *My First 90 Years (A Doctor's Odyssey)*. It will be published shortly. . . . A scholarship fund has been established at M.I.T. by Time, Inc., in honor of the late **Eric Hodgins** who was publisher of *Fortune* Magazine. He was best known for his novel *Mr. Blanding Builds His Dream House*. . . . **Donald I. Gross** of Asheville, N.C. has had a very interesting history of chemical research with various companies including duPont Rayon and Industrial Rayon. He was in the navy in charge of construction and repair during the war, spent some time at Oakridge and travelled with the seventh Fleet to Australia and New Guinea. After the war he continued naval work, inspection and ship repair in Japan, finally ending his service in Norfolk, Va. He retired from active duty in 1963 with the rank of Commander, U.S. Navy.

Our class is saddened to hear of the loss of **Randall W. Meech**, Pasadena, Calif.; **Raymond S. Bond**, San Francisco, Calif.; and **James L. Truslow** of Freeport, Maine. We send their families our sympathy.

New addresses received include Vice Admiral Frank E. Beatty, Malibu, Calif.; Laurence B. Davis, Boston, Mass.; Norman J. Greene, Newton Square, Pa.; Dr. James L. Guardo, Hanover, Maine; Dr. Paul S. Johnson, Bethesda, Md.; Albert E. Smith, Venice, Fla.; Roland L. Smith, Delray Beach, Fla.; Nathan J. Snyder, West Palm Beach, Fla.; Frank L. Youngs, Mesa, Ariz. . . . Buffalo is still enjoying summer golf conditions well into December. Please write newsy notes to entertain your secretary during the deep freeze in February, and plan for the 50th in June. We'll have a ball! **Whitworth Ferguson**, Secretary, 333 Ellicott St., Buffalo, N.Y. 14203; **Oscar Horovitz**,

Assistant Secretary, Pompano Beach, Fla. 33060

24

As I sit in my den, peering out the picture window, those beautiful (no use to consider them otherwise) exploded white water crystals drift onto the road and lawns. I contemplate the imminent shower that my snow-blower will throw and grieve for our 'mates unchallenged by their Florida weather.

In Washington, D.C. recently, I tracked down **Leo Grossman**, still advising the government on highways. It developed that his daughter and son-in-law, now in Iceland, and our son #1 in Washington are both in the State Department, economic section. . . . **Bill MacCallum** and Eleanore had a wonderful time in Paris and England last summer—rehearsals for the Queen's birthday ceremonies, massed Scottish bands and a boat ride down the Thames reminded Bill of the Charles River. Guess that he had not heard of the anti-pollution project which accumulated tons of oil drums, tires and supermarket carts, but failed in deodorization. . . . **Paul Cardinal** writes, "You jumped the gun, Russ" on his Florida move, forgetting that no one jumps the gun on me as the official M.I.T. track meet-starter for years. At any rate, the shot brought **Pret Littlefield** out of the bushes, revealing that he will be Paul's neighbor after November. A conspiracy of ex-class presidents? . . . We said previously that **Paul Tishman**, financier and art collector, was Honorary Chairman of the November 4 meeting of New York Alumni in the Metropolitan Museum of Art. It drew the largest alumni turnout in recent memory and began at 6:00 p.m. with a reception for Dr. and Mrs. Wiesner. Paul will be co-chairman with Dr. Wiesner on the newly formed M.I.T. Council for the Arts, announced as, "within the M.I.T. family, rather than the public at large." The Council will be a permanent national organization of faculty and students bringing a new element to the Institute's life, expanding our commitment to education and augmenting aspects of the creative arts through research, teaching, dissemination and action.

Robert L. (Bob) Morton, Jr. spent a year with us for his S.B. in electrical engineering, coming from Washington University. He drifted to Pensacola, Fla., last year aiming to give Arnold Palmer a hard time, playing golf three times a week. He not only lives a half-mile from the clubhouse, but across the road from the eighth tee. Sounds like a cagey choice for a ball supply from "out of bounds." . . . **R. Bruce Lindsay** capped his illustrious career January 1, 1971 as emeritus professor of physics at Brown University. He is a member of many professional societies, has held important offices, been a consultant for the Bureau of Ships, U.S. Navy and written many books and papers in the field of physics, acoustics and philosophy of physics. . . . **Albert S. (Andy) Anderson** seems to be a resident of Larchmont, N.Y., but reports that he applied some

of his electrical engineering experience with Ebasco Services to an A.I.D. power project in Saigon during January and February.

Fortunately for your reporter, the Alumni Fund money-handlers forward contributors' envelopes (empty) to him, if there are notes on same. **Hugh M. Craigie** retired last year and moved to Grand Junction, Colo., this year. He says that he is spending his leisure time getting acquainted with the area. As he spent a good many years mining in Mexico, could this mean that he is prospecting for uranium in them thar hills? . . . Last we knew, **Blanchard** (Nickey) **Warren**, a local product, was in Oregon, but his envelope is postmarked "U.S. Postal Service." Being a Course XV man interested in figures, he notes that **Ed Moll's** October letter plugging our Fiftieth Reunion Gift indicates an incorrect ratio percent on the second page (71.6 per cent, not 73.7 per cent) and suggests that Ed have his slide rule synchronized or wear his glasses. . . . We note that **Rock Hereford** has received an Alumni Association Presidential citation for his efforts on the San Francisco Educational Council. This explodes the generation gap theory, as Rock appears to be the oldest Council member.

I regret to report that several of our number have been called from their labor by the Grand Master. Our thoughts and sympathy are with the respective families. "Commander" **Oliver D. Colvin, Sr.** was a 1921 graduate of the U.S. Naval Academy, and received a master's in naval architecture from the Institute. He was founder and board chairman of the Cargocaire Engineering Corp. and widely recognized as father of marine dehumidification systems. A member of a number of professional societies, he took an active interest in community affairs of Hampton, N.H. . . . **John S. Davey** passed away November 25 in Greenwich, Conn. He took mechanical engineering and retired as a vice president of Russell, Burdsall and Ward Bolt and Nut Co. of Port Chester, N.Y., in 1961. . . . **Charles R. McCutcheon** died September 17, 1971. Information on him is limited, but his last address was Mountain Lake Park, Md. Apparently he was a transfer, getting his degree in engineering administration and spending some time with the Securities and Exchange Commission in Washington, D.C. . . . Your scribe represented the Class at memorial services in Cambridge for Oscar Hedlund who died December 8. Oscar was track coach at M.I.T. for 35 years, retiring in 1958. Always a gentleman, he built character into many athletes. I shall miss a very good friend.

Christmas cards are bringing notes of interest. **Donald E. Moore**, while civil engineer, Lieutenant Colonel U.S. Army and East Machias Camp luminary and Betty are justly proud of their only progeny, Dr. Sandra Moore Faber, recently awarded her Ph.D. from Harvard in astronomy. After delivering a colloquium at the Harvard Observatory on December 7, Sandra will begin her duties as Assistant Professor at Lick Observatory, University of California at Santa Cruz. She will live in Palo Alto, where husband Andy,



Hoyt C. Hottel, '24, Professor Emeritus of Chemical Engineering, waits his turn while Jack B. Howard, Assistant Professor of Chemical Engineering, autographs

a copy of their book, *New Energy Technology—Some Facts and Assessments*, before presenting it to Jerome B. Wiesner, President of M.I.T. (right).

master's in physics, will buckle down for three years of law study. Sounds like an attempt to prove that the constellations are illegal. Don's letter ends, "Lang may yer lum reek." May be Scottish, but looks like the typist reversed the "l" and "r." . . . Another surprise—"For the Fun of It" by **Maynard (Lank) Harris**, engineer, horseman and banker turned author, with illustrations by son, Chris. One chapter, a homily on the purchase of an extension ladder, reveals how frustration may cause physical relapse to the point where one could not climb it anyway! . . . Your Valentine!—**Russell W. Ambach**, 135 Aspinwall Ave., Brookline, Mass. 02146

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This comment from a classmate deserves to be printed in the largest type possible and in an appropriate colored ink. "In response to Sam Spiker's letter I have now doubled and redoubled my last year's contribution and am counting on him to clear all the hurdles." My editorial reference is to Luke X, 37. . . . **John Ramsey** writes from South Carolina that retirement has continued, no cruises this year but he has been occupied with building a new house which they expect to occupy soon. . . . **Milt Salzman** is at present enjoying leisure after undergoing a retiring unretiring process. Principal activities are golf, bowling, home projects, grandchildren caretaking, and barbershop quartet singing. The last he states is a wonderful hobby. Personally I like the initials of this organization, SPEBSQEA.

Finley B. Laverty, Pasadena, Calif., was given the award of Honorary Membership in the American Society of Civil Engineers at the Awards Luncheon of the Society's Annual and National Environ-

mental Engineering Meeting at St. Louis, October 20. He was cited for "his dedication to furthering the status of the engineering profession and for his outstanding contributions to the field of water resources development and conservation." Finley has had a long and varied career in this area, not only in the development of techniques but in work in the student chapters of A.S.C.E. He has been active in the Los Angeles region and has served as a section president and as a national director of the Society.

I regret that I have to report the passing of the following members of the class: **Richard P. Booth** of Boonton, N.J., October 16, 1971. Dick had a long career of 41 years with the Bell Labs of the American Tel and Tel Co., from which he retired in 1966. In 1955 he was appointed director of military communications systems engineering and was involved in government projects on the Early Warning System and the Mercury Program of Manned Space Flights. He was named director of program management studies in 1964. He was also active in community affairs in West Orange. He was a former trustee and deacon of the Ridgeview Community Presbyterian Church and district chairman of the Oranges and Maplewood Boy Scout Council. He leaves his wife, Mrs. Ann G. Booth, two daughters, two sons and 14 grandchildren. . . . **Thomas R. Camp** of Boston, Mass., November 17, 1971. Tom was the founder of Camp, Dresser and McKee, a Boston based concern of environmental engineers. He was a native of Texas, a graduate of Texas A and M College and received his master's degree from M.I.T. He was awarded a degree of doctor of science by the Clarkson College of Technology. From 1929 to 1944 he was professor of sanitary en-

gineering at M.I.T. He was an honorary member of the A.S.C.E. and a life member of the American Water Works Association. A past president and honorary member of the New England Water Works Association, he also served in the same capacity for the Boston Society of Civil Engineers. He leaves a son, two daughters, and five grandchildren.—**E. Willard Gardiner** (Will), Class Secretary, 53 Foster St. Cambridge, Mass. 02138

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Pete Ruggles has written a letter about his reaction to our 45th reunion which typifies what so many have told us that it is worth quoting: "The Ruggles sure enjoyed the get-together at Chatham—our first since the 25th that I attended alone at the Griswall at New London. It sure was our pleasure to see everyone. We took some pictures and have sent prints for their memory books to the Salmons, Goldbergs, Dave Harrison and Don King. While in Chatham we were able to visit some old friends including a fellow classmate in Course XIII, **Spaulding Dunbar** who established his life work there in Chatham—boat design and building and a marina. He had hoped to join us but wasn't feeling quite up to it. We did enjoy most certainly the hospitality at the Salmons in Hingham—likewise the Pops. We have so many great memories—long lasting. Our thanks and gratitude to those who put this get-together in the works."

We have a whole flock of notes from the flaps of the envelopes that you send to the Alumni Fund. Please keep it up everyone—they are a tremendous help to a class secretary. These are all about retirement activities. . . . From **Bill Millar** we have this note: "I am 89 per cent

retired with two daughters still in college. As Bean Lambert says, 'fantastic.' The cost of keeping them there is. In Arizona for 12 years, with 80 acres under cultivation from my neighbor's horse and one goat. Busy as hell doing nothing much; same weight as in M.I.T. days; hair lessening. Filling time, between the 'nothings,' writing a book regarding African Banditti, Russian crown jewels, black Mambas and such. Not in a hurry though; my mother eased away at 96." . . . **Alan K. Laing** writes: "Retired from active teaching and administration at the University of Illinois as of September 1971 and will be spending the autumn in France. Will continue to live in Urbana, however, for foreseeable future and hope to find time to complete those long postponed projects like writing to Honorable Secretary George Warren Smith."

Horace Nason retired February 1, 1970 after 43 and a half years with Westinghouse Electric Corp.—36 of which were in the Chicago office. . . . **Whitney Ashbridge** is "managing to keep very busy though retired. Enjoyed our cruise to Colombia, Panama and Ecuador. About to leave on motor trip through Quebec and Nova Scotia. Still hoping to get to Africa next May (the trip that had to be postponed when I had that mild stroke last March.)" . . . **William W. Farr** writes: "I retired from Rohm and Haas Co. on February 29, 1968, after 28 years service. On November 23, 1968, I remarried. We lived in Chapel Hill, N.C., for one and a half years but in August 1970 we moved to Southern Pines, N.C." . . . **Francis P. Romanoff** writes: "I am retiring this year and being retained as consultant under a contract with a retainer fee. Plan on getting to Tucson, Ariz., this coming year, God be willing."

Our classmate Stark Draper continues to receive medals and awards but the one we report here is a little different. "Four scientists, two from the United States and two from England were awarded the 1971 John Scott Medal for useful inventions benefitting mankind. Among those honored is Professor **Charles Stark Draper** of M.I.T. for the invention of the First Practical Inertial Guidance System. The award, which consists of \$4,000 each for the men was established in 1816 by John Scott, a chemist of Edinburgh, Scotland, who bequeathed \$4,000 in trust to the City of Philadelphia. Today, the Fund amounts to almost \$120,000.

"The older methods of guiding aircraft such as compass and radio are completely inadequate for today's high-speed craft and are completely unusable for space vehicles. Inertial guidance systems have proved to be the answer and inertial guidance is now used on aircraft, submarines, surface vessels and space vehicles. The system is completely independent of magnetic forces (compass) and radio beams. The work of Professor Charles Stark Draper has made possible the practical inertial guidance systems now in use."

It seems that John Scott had a great idea for perpetuating his name and associating it with the great down through the years, for among those upon whom it has been bestowed are Thomas Edison,



Left to right: Bob and Barbara Wallace, Peg and Jack Pinkerton, Class of '27.

Madam Curie, Dr. Jonas Salk, Sir Alexander Fleming and now Stark Draper. The worth of the award, aside from its increasing monetary value, becomes more valuable as the names of recipients are added. We are proud to have a classmate on the list.

Alvin Gutttag, Secretary of '40 has sent us the following clipping of a fatal accident that befell a renowned classmate. "**George S. Mikhalapov**, a retired nuclear engineer who was a codesigner of the U.S.S. *Sea Wolf*, an atomic submarine, was killed November 3 when his car collided with a fuel oil delivery truck. He was 65 and lived in Devon, Pa. A native of Kiev, Russia, Mr. Mikhalapov came to the United States in 1923 and graduated from M.I.T. in 1926. His father was an officer of the Russian Imperial Guard. He is survived by his wife, the former Anne Biddle; a daughter, a stepdaughter, and a stepson." The class extends its sympathy to Mrs. Mikhalapov and her family.

And that brings us to our Happy Washington's Birthday greeting and Cheerio!—**George Warren Smith**, Secretary, P.O. Box 506, Pigeon Cove, Mass. 01966

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John F. Healy's widow has advised us of John's death on September 14, presumably in Nutley, N.J., where their home was at 5 McKinley St. John was from Winsted, Conn., and came to M.I.T. from the Gilbert School. At Tech, he played basketball, worked for *The Tech*, graduated in Course XV. He worked for American Oil Co., in Bridgeport, Conn., and then became American's director of engineering at Newark, N.J. . . . **John Pinkerton's** wife, Peg, died November 21. This came very soon after Barbara and **Bob Wallace** had visited the Pinkertons in Daytona Beach, Fla., Bob wrote: "We had two most enjoyable evenings with them and a day of golf. We had not seen them in about 40 years, so it was a real pleasure to take up where we left off. I had had the pleasure of introducing 'Pinkie' to Peg while at M.I.T.

Enclosed is a picture taken after sundown as we were late getting in from golf." Then came another letter from Bob saying that Peg had died of peritonitis, caused by a ruptured appendix.

Ruth and **Joe Burley** found their way to Masons Island—accessible by highway—and their visit was thoroughly enjoyable. They had been in nearby Waterford, visiting their daughter, Jane, who has taken a semester away from Vassar to attend the Eugene O'Neill Memorial Theater Center to further her interest in acting. Joe's interest in Hilton Head, S.C. had caused him to write **Carl Davies** in Charleston, S.C. Carl's answer calls Hilton Head "delightful", and it also gives us a line on Carl's doings: He is still in the lumber business, not retired, still does a modest amount of travelling and selling. For recreation, boating and fishing, owns a Drifta Cruz houseboat which he calls a "glorified trailer on a raft." Has plans for attending the reunion. (Have you?)

Nat Cohn has reached the top of the ladder in his long association with the Franklin Institute, having been elected chairman of the board. . . . There was a minor 1927 reunion at the 48th reunion of the Winthrop, Mass., High School class of 1923. **George Jenkins** writes that **Willard Felch**, **Gordon McNeill** and he were there. Samuel Weibel, M.I.T. '28, joined them. George spent five weeks in Britain last summer "travelling and visiting hosts of cousins." . . . **Les Woolfenden**, retired in Paducah, Ky., is busy consulting with G.A.F., his former employer; also director of a local bank, chairman of building committee building a thirteen million dollar hospital, and chairman of the industrial development committee of the local chamber of commerce. . . . Last summer Ruth and **Pub Whittier** enjoyed a 42-day North Cape cruise. On their return they visited Molly and **Jim Lyles** in Caanan, Conn. Pub is still helping **Dick Cheney** with his high speed bottle-filling machinery. . . . The **Charley Smiths** got off to an early start (November) on their winter stay in Green Valley, Ariz. They also hope to make a side-trip to Mexico . . . **Charley Sanborn** has much of interest to say about his retirement, referred to briefly in the last notes: "Here we are retired on Cape Cod (West Yarmouth) and finding it much to our liking. We are in a modest five-room house and built as houses are today, I never lack for a project or two to re-do. After 35 years in Ossining and the last 30 in our home on Narragansett Ave., believe me there was some accumulation of 'stuff' to move. What to throw out; what to keep? One item I was grateful to have saved was a renewable Massachusetts driver's license issued to me in 1927. That piece of paper got me a Massachusetts license without an exam! Have reached the point where I can give more time to 'ham' radio—call sign WA1PJ1. It's really a great hobby and can take more time than XYL (Mrs. Sanborn) appreciates on occasions."

George Thacher has done a job which I wish many more classmates would do: write up a short record of 1927 to date. His reads: "Worked in construction department of the Pacific Gas and Electric

Co., California, from 1927 to 1959, helping to build hydro power plants. In the crushed-rock business in Richmond, Calif., 1959 to 1963—sold business—worked for Parsons Tudor Bechtel engineers on Bay Area Rapid Transit, San Francisco, tunnel construction 1964-68. Retired 1968. Married Helena Duryea 1934, 2 sons, 5 grandditto." . . . **Charley Hurkamp**, who was with Lockheed in Marietta, Ga., for years, now has an address at 1 Bayard Ave. Rd., Hilton Head Island, S.C. Again it is hard to tell whether this is a major retirement home or something for the future. In any case Charley and Joe Burley (see above) should get together to weigh the merits of the place. . . . We have received notice of an address for **Russell Taylor** at 155 North St., Greenwich, Conn. Russ has been president of A.C.F. Industries Inc. . . . Another address change which may signal a retirement is **Barnett Silveston's** to 3810 Park Newport 320, Newport Beach, Calif. . . . Likewise, Miss Hilda Young at Box 945, Nogales, Ariz. . . . "And that's the way it is this thirteenth day of December, 1971."—**Joseph S. Harris**, Secretary, Box 654 Masons Island, Mystic, Conn. 06355

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Henry LaCroix has joined the growing number of '28 retirees. A news release from Foster Wheeler Corporation of November 1, 1971 states "Mr. LaCroix joined the company in 1937 as an engineer in the process plants division. His positions as process engineer, project manager, and department manager have taken him to field sites in 14 countries. For five years he was technical managing director at Foster Wheeler's Japanese affiliate, Ishikawajima Foster Wheeler." He will retire from the company's Livingston, N.J. offices to become senior consultant, Process Plants Division. The LaCroix family includes Nap, his wife Gertrude, and their two daughters, Suzanne and Jacqueline. . . . Harold F. Dodge, secretary of '16, very thoughtfully sent us the November 1971 issue of the monthly newsletter for the International Division of Otis Elevator Company. In it the retirement of **Herman Krantz** was announced. Herman was president of the associated company in Italy, Stigler-Otis S.p.a., and had been with Otis more than 43 years. The release further states: "During his service in Italy, Mr. Krantz has been active in civic affairs and has received many honors. He has been president of the American Chamber of Commerce since 1942 and is a member of the Rotary Club of North Milan. In recognition of his contribution to business life in Italy he was named 'Commendatore' of the Order of Merit of the Italian Republic in 1964. He was further honored in 1969 by promotion to the rank of 'Grande Ufficiale' in the order. The honor was conferred by citation of the Italian President, Giuseppe Saragat."

The following three items are from Alumni Fund envelope news panels: **Lawrence Glassman** writes "In June 1971 Ellen and I had the great pleasure of a

visit from Helen and **Gabriel Disario**, their daughter Caroline ('56) and her husband Russell Chihoski ('54). Also in June our older daughter Alice (Mrs. Alan Polin) had a son, Adam, making us grandparents for the first time." . . . **Charles W. Ricker, Jr.** says "I was 65 on September 2, 1971 but have a six-month extension with Chicago Transit Authority. My daughter Sally is married and living in Princeton, N.J. She has three children. My son Charlie was married on Labor Day, 1971. He is living in Des Plaines, Ill., and working for IBM." From **Karl Otte** we have "As of August 31, 1970 I retired from being a professor teaching mechanical engineers at the Chicago Campus of the University of Illinois. This was my second retirement. I came to the University of Illinois in 1963 after spending 20 years supervising engineering research for American Bakeries Co., a multi-plant nationwide manufacturer of bakery products."

Jim Donovan was busy promoting his company's interests at the Chemical Industries Exposition in New York City during the week of November 28, 1971. Two classmates stopped to visit with him at different times, **Franklin McDermott** and **Henry LaCroix**. Jim also received a card from Beryl and **Elbridge Atwood** while they were in Basel, Switzerland. They wrote: "We have been here to see (son) David and to have a little vacation. We covered some of our favorite places but had to skip London—the hotel situation was just too tight. We have good weather for the Swiss Alps but think it is a bit late to make mountain climbers of us." . . . We had the pleasure of chatting with a number of classmates during a recent telephoning session and have the following brief notes: **Clark Merrick** is still active as an architect and has his office in Boston. He has not had much contact with other classmates but did meet recently with John Clingan '29 in New York. . . . **Peter Duncan** had his own monument and memorial marker business at Woodlawn Cemetery in Everett, Mass., but is now retired. He keeps in shape by riding his bicycle at least once a week. **Dave Moore**, who many will remember was a member of the freshman and junior varsity crews, reports that he is retired from Jones and Laughlin Steel Co. His office was at the company's stainless steel plant near Canton, Ohio. . . . **Milton Thompson**, M.D. (Harvard) has his own practice in San Antonio, Texas and is still going strong with no thought of retiring. He still hunts and bagged two deer this season. . . . **Norman Winter** retired from General Time, Inc. in January, 1969 and is now living in Sun City Center, Fla., where he likes it very much. He brought his horse along when he moved from Evanston, Ill., and enjoys riding. The Winters participate in local civic and veterans' activities.

Harry Hardsog talked cheerfully on the telephone but reports that he has been disabled the past 11 years. He can get about with some limitations and keeps himself busy with various handcraft hobbies such as woodworking and leathercraft. He says that he and his wife Hope are in good health otherwise. . . . **Jim Tully** has retired to Fryeburg, Maine as he always

wanted to do. He says the skiing is wonderful in the winter months. In November he attended a meeting of the M.I.T. Club in Portland. . . . **Howard Batchelder** has been with Battelle for 18 years and is now working about half-time. Three of his projects have taken him to Venezuela. He likes to fish in his free time. . . . **Cal Caldwell** says he is still breeding horses and races a few of them. His son studied at agricultural school and is now working the farm. The Caldwells report seven grandchildren and were expecting the eighth at the time of conversation. . . . **Mailloux Coren** is still active and plans to stay in Eastchester, N.Y. His daughter has provided him with three grandchildren. . . . **Ray Jack** has been retired from American Oil Company since 1966. He has a number of community interests and writes for local publications. . . . **Bill Bendz** is still with Lockheed Missile and Space Co. in Sunnyvale, Calif. working in the field of electronics. His daughter has four children and his son has two.

Chet Day retired last June from New England Tel. and Tel. Co. but he remains active in I.E.E.E. He and his wife are in good health. . . . **Vernon Brown** has been retired from the Army Reserve for some time and has been with U.S. TVA., Muscle Shoals, Ala., for many years. His chief interests are his two grandchildren, golf, hunting and year-round fishing. . . . **Clifford Terry** still has a year to go before retirement. He has built himself a home on Tippecanoe Lake not very far from his home in Huntington, Ind. He plans to live at the lake after retirement. His wife, two sons and a daughter are all well.

We are very sorry that we must report at this time the deaths of four of our classmates. **John A. Carollo**, who joined the class as a graduate student in electrical engineering, died September 17, 1971. His home was in Phoenix, Ariz. . . . **George R. Lang**, Course II, died October 30, 1971. He lived at Deerfield Beach, Fla. . . . **Francis L. Stetson** died tragically August 24, 1971 as the result of an assault. Frank, like several other members of the class made his career with Consolidated Edison Company in New York and was close to retirement. He leaves his wife and a daughter. . . . **Leslie B. Cutler**, a class member who took graduate work in Course VII (life sciences), died November 27, 1971 in Needham, Mass. Her professional life was in public service in Massachusetts where she was a member of the House of Representatives 1939 to 1948 and a member of the Senate 1948 to 1968. She served on various health boards and committees and was prominent in the successful promotion of reforms in the fields of justice, women's rights, and public health.—**Walter J. Smith**, Secretary, 209 Waverly St., Arlington, Mass. 02174

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Word comes that **Jerry Gardner** of Belmont, Mass., retired September 1, 1971 as hospital engineer at Beth Israel Hospital after 21 years of service. However,

his retirement was short-lived as he got himself a new job with First Realty Co. of Boston to set up an engineering and maintenance program policy for approximately 3,000 housing units located in Boston, Fall River and Providence. . . .

Rolf A. Zurwelle of Port Washington, N.Y. writes, "thanks for your interest in my activities. Have had a very interesting and exciting life in many fields of activities and have had 40 years of happy marriage with a wonderful girl whom the Lord called home on September 30, 1971. Expect to carry on my business (Zurwelle Co.), product and industrial design and also consulting in many fields. Am still a young guy (65) with ideas and enthusiasm to keep me going until my days run out. Wishing good health and happiness to all."

A brief note comes from **Eric A. Bianchi** of Summit, N.J., saying "Thanks for your greetings on my 65th birthday—I am now on Medicare. No news since I wrote to you last. The birthday card is a good idea and I am glad you are getting a good response. With kind regards." . . .

George J. Meyers, Jr. of West Reading, Pa., writes: "Thanks for your card. That is a real clever way of getting up to date on your classmates. The only thing new is that I have been working my head off in consulting since last October. I made an attempt to put a balanced team on the field early in the year, but somehow we failed to communicate so we finally agreed to part company. I am now taking the slow hard approach of looking around for someone who gives evidence of being in tune with the concept of the operation of a small consulting firm. My second grandchild, Kristian, was born a couple of months ago. Best wishes to you and all the classmates."

Henry S. Muller of Belmont, Ohio, writes that he is retired and living in the Golden Age. For a pastime he raises trees and watches them grow. He says in a few years he will be as old as Jack Benny. . . .

John R. Dunbar of London, England writes, "Still active in too many fields, particularly scouting and philately. Would be glad to exchange Canadian stamps (used) for stamps from anywhere in the world. I was registered at M.I.T. during the 1922-23 session in Course VI-G and registered one term in 1929. I don't think anyone in the class of '29 has ever heard of me."

A note comes from **Frederick L. Bray** of Newark, Del., saying, "How great to receive your birthday card! I was laid off in aerospace cutbacks in 1970—a small price to pay toward peace. I was glad to be taken on at age 62 in the present lowly capacity of construction inspector, University of Delaware, but regret turning my back on many years in electro-mechanical design. My principal concern now is how to avoid retirement next year." . . .

J. Gordon Carr of New York, N.Y., writes, "My son Andy is just starting his second year at M.I.T. in the graduate school of architecture and urban design. So we are keeping our close contact and personal interest in M.I.T. and we are very proud of it."

Nathan E. Promisel of Silver Spring, Md., who has been executive director, National Materials Advisory Board, Na-

tional Academy of Sciences, Washington, D.C. for the past five years has been elected president of the American Society of Metals. Nathan's post-academic career started with research and development at the International Silver Co., from which he departed as assistant director of the laboratory to begin his own consulting business. During W.W. II, he was associated with the Navy Department, retiring in 1966 as chief materials engineer and the materials exploratory development administrator. He is a member of many technical organizations, here and abroad and their committees. A few of these include chairman of the aerospace materials development of the Society of Automotive Engineers; a member of the A.S.M. board of trustees (1965-66); A.S.M. vice president (1970-71); materials advisor to the NATO (A.G.A.R.D.) structures and materials panel (1968-70). He is the author of more than 40 technical papers, co-author or editor of several books and has lectured extensively in the U.S. and abroad.

I deeply regret to announce the death of **Wesley Reynolds**, Chicago, Ill. He was an intercollegiate champion in 1929 as a gymnast and a member of the team at M.I.T. In 1932 he tied for the A.A.U. flying rings championship at the annual Metropolitan Senior Gymnastic meet in New York City. At one point in his gymnastic career, Wesley competed in San Francisco for an Olympic berth. He is survived by his widow, Mary (O'Brien) and two daughters and two sons.

Walter H. Winchel of Garden City, N.J., is chief engineer of Sterling Transformer Corp. of Brooklyn, N.Y. He writes "Am still working hard, designing transformers, some with computers and others without computers, trying to get the same results by both methods. My daughter just graduated from Skidmore College and has an interesting job at Morgan Guarantee Trust Co. My son, a graduate of Rochester Institute of Technology, with a master's degree from Syracuse University, is on a leave of absence from Eastman Kodak Co. while studying for his Ph.D. at Syracuse. My wife Elsie, a former school teacher, went back to work after many years for the Nassau County Department of Social Services as a case worker aide. This helps to pay ever increasing federal, state, New York City, village, school district and town taxes."

After much coaxing, we finally got a good report on the activities of **John J. Wilson**, as follows: "Dear Karnig: You and Frank Mead have urged me to give you some information concerning my recent activities. Our trip on my sailboat **HOLGER DANSKE** as covered in the article in the *Cruising Club News*, takes us only to Madeira. We left there three months later and sailed to Mogador on the northwest coast of Morocco. We then proceeded down the coast of Africa to Las Palmas in the Canary Islands from which point we sailed to Barbados in early November 1968. We had several good days of sailing and some interesting stops along the way in the Cape Verde archipelago, giving us a total of 21 days passage from Las Palmas to Barbados.

"We left the boat in Barbados for three months and then proceeded to sail

through the Windward and Leeward Islands to the Virgin Islands.

Then with a group of five friends I sailed from St. Thomas to Bermuda in late May, spent a few days in Bermuda and sailed on to our home port in Marblehead, returning there within a couple of days of a year after the boat had left on her eastern passage.

"In 1969, with my son, a sophomore at Harvard, we raced **HOLGER DANSKE** to Bermuda with a crew of eight friends. We did not do well in the race, we seemed to be either totally becalmed or in a gale. I have promised to repeat the Bermuda Race in 1972 and we plan to sail from Bermuda to Spain after the festivities. So much for the sailing part of my life during the past few years.

"Over the past five years, I have reduced the number of companies of which I was a director from ten down to two and this has simplified things quite considerably. I still operate two small business concerns but most of my time is taken up with my activities as Secretary of the Corporation at M.I.T. and on various projects and Institute Committees plus my interest as a Trustee at the Boston Museum of Fine Arts, the Peter Bent Brigham Hospital, Milton Academy and the Educational Enrichment Program. Although I am no longer in the operating end of Honeywell, I take an active part as a director of the company and as chairman of its Auditing Committee.

"Since I was invited to become General Chairman of the Second Century Fund at M.I.T. (when we raised \$98,000,000 from private sources in what turned out to be the then largest and most successful educational fund raising program in history) I have been considered by others as somewhat of an expert in this field (a conclusion with which I do not at all agree). As a result, however, I have been hooked into a lot of fund raising activities and seem to spend an interminable amount of time trying to dig money out of others for various causes.

"D. A. and I have established a scholarship fund at M.I.T. and, in addition, the John and Dorothy Wilson Professorship now held by Professor John M. Buchanan of the Division of Biochemistry in the Department of Biology.

"My daughter, Eleanor, lives with her husband and four children in Greenwich, Conn. D. A. and I have three children. Sarah, the youngest, is entering Swarthmore as a freshman in the fall of 1971; Richard will become a senior at Harvard majoring in mathematics; Anne, our oldest, who attended Radcliffe, is now taking a few years off from her studies.

"I do not plan to have an actual retirement date at 65, but I certainly hope by that 'normal retirement date' I will have things arranged and will be in good enough health so that D. A. and I can spend more time at our place in Barbados and at sea on **HOLGER DANSKE**."

Wilfred J. Danziger of Bronx, N.Y., writes, "Although I had expected to keep on working at least until I was 65, the decision of my employer, M.W. Kellogg Co., to move to Houston in 1970 made me change my mind and I accepted early

retirement starting June 1970. I had been with Kellogg since January 1942 specializing in heat transfer. This winter I hope to go on a schedule that will include daily practice on the fiddle. We are making no plans at this time for travel or special projects. A week after the '69 reunion, we were busy with plans for a vacation and when we returned something came up that held up my correspondence. At this late date, therefore, I would like to praise the 40th Reunion Committee for the good job they did and to thank them for their courtesies." . . . A note comes from **J. Sarto Nadeau** of P.Q., Canada, as follows, "Still living. Retired five years ago after 34 years with Imperial Oil, Ltd., a subsidiary of S.O.N.J. in Canada. Thanks for your birthday wishes which arrived on the very day of my birthday (November 23). I am enjoying my pensions with a bit of travel, family visits, gardening, fishing and golf." . . . **Leslie E. Simon** has retired from the army as major general and lives in Winter Park, Fla., with his wife Marie . . . **Frank Buckle** has retired as mining engineer and lives in Green Valley, Ariz., with his wife Margaret. Frank is recovering from a recent stroke. . . . **Ralph H. Crosby** has retired from Shell Oil Co. after 40 years of service and lives in Sea Bright, N.J., with his wife Joan. The Crosbys attended our past 40th Reunion.

Your executive committee, under the leadership of president Frank Mead, has arranged an informal mid-winter get-together at the Bay View Country Club in Orlando, Fla., for three days, February 22, 23 and 24. Any Twenty-niner who wishes to attend (wives are welcome) please contact your secretary, either by phone (305) 946-0425 or writing to the address below for details and reservations:—**Karnig S. Dinjian**, Secretary, Apartment 14-E, Starlight Towers, 6000 N. Ocean Blvd., Fort Lauderdale, Fla. 33308

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Again this month we have several retirements to report. As of July 1, 1970, **Earl Ferguson** retired from the New York Telephone Co. In addition to the usual retirement activities he has found an especially useful and rewarding job, which he describes as one-to-one tutoring of people in Newark in connection with preschool classes "that are given for those who are preparing to take high school equivalency tests. The Fergusons' daughter Priscilla graduated from Middlebury College and is presently director of the greeting card program for the U.S. Committee for UNICEF. . . . **Graham Walton** has retired "except for a limited amount of consulting work, but not enough to interfere with golf and travel." According to my records Graham was associated with the U.S. Public Health Service in Cincinnati prior to his retirement. . . . **Elizabeth Rossman Everett** has retired after having taught secondary school mathematics for a number of years. Her husband Edward is a vice president of New York Life Insurance Co. in charge of corporate organization and security investments. Their son, Edward Jr., graduated from Harvard A.B. '67 and Harvard

Graduate School of Russian Affairs '68, received an M.A. from Boston University in '70, and is now working on a Ph.D. in political economy at B.U. Daughter-in-law Lila won a four-year N.S.F. fellowship to Harvard Graduate School and is preparing a dissertation on Russian history at the School of Russian Affairs. Elizabeth is a member of the Scarsdale Women's Club, the Woman's City Club of N.Y., and has recently been asked to serve on the Alumni Council of Teachers College at Columbia. She says that she would like to hear from some of the other coeds in the class, which leads quite naturally to the next item. . . . **Louise Hall**, another Course IV coed, took a sabbatical semester away from Duke this fall. She "worked into research gradually by way of meetings at Winchester in Hampshire and the University of St. Andrews in Fife."

Harry Fekas is doing engineering reviews and staff work at Langley A.F.B. in Virginia. He and his wife Athene live in Newport News where he says that an organizational meeting to form a new M.I.T. Club is scheduled for January 1972. It appears that there are 128 potential members in the area. The Fekas have two married daughters and five grandchildren. . . . **Les Engler** is still Dean of Administration at the City College of New York, struggling with the financial problems that many of us have read about. He is also president of the Tenafly Civic and Welfare Association and a trustee of Englewood Cliffs College. The Englers have three children: John, who is a candidate for a Ph.D. at Oxford University in England, currently on leave and teaching at Fairfield University in Connecticut; Robert, who received an M.S. in urban planning at M.I.T. and is working for an urban planning consulting firm in Cambridge; and Ellen, who after 2½ years with the Peace Corps in Thailand is working for the Public Broadcasting Service in Washington, D.C. Les says that as he reads about the retirements in our class he realizes that he has been eligible for a number of years but hasn't set a date yet. He wonders whether "at this stage of life will the opportunity to play more golf improve your score or will 'old man time' more than offset it?" . . . "**Mannie**" **Birnbaum** was appointed Chairman of the Board of Governors of the University of Guelph as of January 1, 1972. . . . **Haskell Small** has received a presidential citation for his work on the 1971 Alumni Fund in the Washington, D.C. area.

We have at hand a report that **Peter Kallelis** died on July 19, 1971. Unfortunately I do not have any information about him in my records other than the fact that he was at one time associated with Merritt Chapman and Scott Corporation. Changes of address: Wilfred F. Howard, 31316 Summer Lane W., Fraser, Mich. 48026; John B. Osborne, 112 Mill Rd., No. Hampton, N.H. 03862; Captain Joseph E. Rehler, 77 Wentworth St., Portsmouth, N.H. 03801; David Giller, 171 Foster St., Brighton, Maine 02135; Daniel T. Walker, Star Route 2, Box 238, Center Harbor, N.H. 03226—**Gordon K. Lister**, Secretary, 530 Fifth Avenue, New York, N.Y. 10036

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You have been hearing about the 40th Reunion in June and we hope that you have been making plans to attend. We have already heard from a few classmates who are planning to come to a reunion for the first time in 40 years. This is an encouraging trend. The reunion will be housed on campus in one of the newer dormitories. Activities will begin with registration and cocktails on Friday evening, June 2 and carry through Sunday evening when Alumni Day activities begin. Alumni Day, Monday June 5, will include luncheon ceremonies at which our 40th Reunion class gift will be presented to M.I.T. Plan now to come to the 40th.

Ray W. Hawksley writes that water technology must be replacing rockets since those in this new field are pretty busy. He has enlarged and instrumented the pollution laboratory almost to the exclusion of wet chemistry and gravimetric analysis, and is now looking for picograms instead of milligrams of heavy metals. . . . **Henry Rockwood** of the National Oceanic and Atmospheric Administration was awarded the Department of Commerce Silver Medal for "his initiative and extraordinary leadership in improving the quality of weather observations." Henry is chief of the Data Acquisition Branch in the N.O.A.A. National Weather Service's Eastern Region, headquartered in Garden City, N.Y. . . . **Christian E. Grosser** was recently elected a Fellow of the American Society of Mechanical Engineers. He has been engaged in engineering consulting in private practice, specializing in machine and instrument design. He is also serving a ten-year term on the Virginia Board of Registration for Architects, Engineers and Land Surveyors. . . . **Arthur B. Metcalf** has been reelected to the board of trustees of Franklin Pierce College. Arthur is president and director of the Electronics Corporation of America in Cambridge and is also a trustee of Boston University.

Charles A. Spiegel of Redondo Beach, Calif. has presented his amusing lectures on mathematics as a pure fantasy with Martian teachers. Too few people are aware that mathematics is inherently a fantasy world where "truth is what I say it is—a fantasy definition." His use of the fantasy format in his presentation helps make mathematics clearer for young learners. . . . Hot on the heels of Man on the Moon, comes *Math on Mars*. Charles Spiegel's creative new form of writing the textbook novel, combines fantasy with scientific fact. A male math teacher and a female biology teacher are sent in a cryogenic condition to observe life on Mars and to give particular attention to their method of math. They find the Martians a tetrahedral, three-eyed race with sensitive tentacles of purple and green. It is said that this book is for everyone who has struggled with the new math, as well as for everyone who enjoys a good story well told. Charles was a consulting engineer and served in the Corps of Engineers during World War II and completed graduate

work at the University of California, Bucknell University and the University of Southern California. He is now teaching at Pacific State University in Los Angeles.

Gaynor Langsdorf is serving as chairman of the Regional Council for M.I.T. Alumni Affairs in Northern California. This council provides a means of coordinating all alumni activities by bringing them under the "Big Tent" concept. They started in June with a dinner for activity leaders with President Wiesner as guest speaker. . . . **William H. Barker** writes that he and his wife enjoyed their trip to England last November. He was hospitalized three weeks in April but is now back in stride and looking forward to the 40th reunion. . . . **Captain W. C. Sprenger** has retired after 12 years at Yakima College, Yakima, Washington where he has been teaching engineering transfer courses. . . . **John A. Fellows** retired from the staff of the American Society for Metals in November 1970. He has been doing some consulting work and is now working full-time on the editorial preparation of material for volume eight of the *A.S.M. Metals Handbook* (Failure Analysis and Prevention).

We extend our sympathy to **Oliver Scharnberg** whose son, Major Ronald Oliver Scharnberg was killed in South Vietnam on March 17, 1971. Ronald was a career officer and had been recently married. . . . We regret to report the death on November 2, 1971 of **W. Robert James** of Glen Oaks Ave., Summit, N.J.—**Elwood W. Schafer**, Class Secretary, M.I.T. Rm. 13-2145; **James Harper**, Assistant Secretary, 2700 So. Grant St., Arlington, Va.

33

First, our sincere thanks for all the Christmas cards received. Leona and I are glad to hear from so many, even though numbers alone prevent our replying. However, some contained short messages, and these we love a bit more. . . . **Dyer Potter** says that he is still working, but retirement is close; they are to tour Spain and Portugal in March or April come what may. . . . From **Bill Baur** comes a change of address which is merely a confirmation of the "Honeymoon Lane"-bit a month ago. Bill says that he will spend about six months South and the other six in New England. Best of luck to each of you two characters, and thanks for your thoughtfulness with the personals.

From M.I.T., a press release tells that **Edwin R. Gilliland** has been awarded the honorary title of "Institute Professor." This makes two of our boys who have been so honored; **Norm Levinson** is the other. Ed has been the Lewis Professor of Chemical Engineering since 1969, and is one of the country's leading authorities on fractional distillation of petroleum, synthetic rubber, and, water purification. Ed came to us with a master's degree and took his doctor's in 1933. He is a member of the National Academy of Sciences, and the National Academy of Engineering. The sincere congratulations of our class go to you, Ed. . . . From an

unexpected source, the 1933 40th Fund Committee, in the person of Linc Ryder, comes word that Colonel **Dominic Chiminielo**, of San Antonio, has retired after many years with the Army Chemical Corps. He is teaching part-time and is active in government contract negotiations in San Antonio. That's it on Dominic. I'd like to hear from him direct. . . . Linc also visited with **Charlie Cashman**, Fitchburg, Mass., by way of the Telethon. It seems he is now retired from a paper manufacturing concern in Fitchburg and is working into a law practice, based on his night school law education. Golly, here is a guy who has had a law degree for years but never did practice. One should never retire, but should choose something or other on which to spend some time to keep from decaying mentally. Here is a splendid way of doing it. Charlie, won't you write a short treatise on how fellas like you do such things? It may help others not so resourceful. Thanks for giving Linc this fine story, Charlie.

From by far our most dependable news source, Cal Mohr, comes some results of a stop in Rochester, N.Y. to visit **Otto Putnam**. Now in retirement, he is in the antique business and attends many shows all over and is now specializing in old tools and furniture. The Putnam children are scattered all over, California, Idaho, and New York State. . . . **Dave Babcock** told Cal that he didn't know he was on the 40th Gift Committee. My, my, he thinks that he is unique which is far from so. One may always write Ken Brock with questions about how one is appointed to these committees. Dave apparently got a late start, as he is still busy with his children and cannot yet retire from Eastman. One son is in the boat business in Florida, and another is now an intern in medicine.

We have a quick release from M.I.T., called "Presidential Citations." These citations are awarded to alumni who have been active in the year past, in such activities as the Alumni Fund, the Educational Council, and area clubs. These awards are usually made either at Alumni Council meetings or at one of the various regional conferences. All this leads to the fact that, again, **Wilber Huston** has been recognized for his Alumni Fund work in and around his area, Washington, D.C. Our most sincere congratulations, Bill. He was the only 1933 name on the list of two double column pages.

Now for the Alumni Fund capsules: **Fred Aldrich** writes from Seattle that, as his retirement approaches, he thinks more of New England and his home town of Chester, Mass., in the Berkshire Hills. He hopes to build a small home high up overlooking Chester and the lovely countryside. . . . Praise be, we have one from **Bob Dillon**. I had about given up. Bob is in Puerto Rico helping to start a new installation of Union Carbide, for production of ethylene oxide and ethylene glycol, whatever those are. The new plant is at Peñuelas, Puerto Rico, on the south shore of the island, near Ponce. Bob says that he and his wife have a fine apartment with an excellent view of the island's highest mountains. From memory, this must refer to the rain forest area.

May God Bless the Alumni Fund Capsule; here I have one from almost a total stranger. From Lincoln, Neb., comes news of **Robert A. Dobson**. A most active and capable man, he became this year chairman of the board of Dobson Brothers Construction Co. Bob has two sons, ages 36 and 30, now in the same firm; he also has four grandchildren. He is board chairman of the Chambers-Dobson Insurance Co., and is a director of the National Bank of Commerce, Kearney First National Co., Security Mutual Life Insurance Co., Lincoln Steel Corp., Cooper Foundation of Theatres, Lincoln General Hospital as well as a trustee of many other foundations. This most remarkable man deserves our sincere congratulations and praise. . . . It is always a pleasure to hear from **Tom Fitzpatrick**, who is busier in retirement than he ever was as a teacher. He is still working with the Historic Savannah group and is supervising some projects for them. He is also involved in a land use study of Skidway Island, one of the barrier islands off the coast. The program, whose aim is to protect the bird and animal life on the island, is affiliated with the Oceanographic Institute now located there. Son, Kevin, is production floor manager for W.S.A.V. TV, New York. Son, Bill, is still running the ranch at Wellington, Colo., doing a job of Hereford cross-breeding. Us Angus fellas allow that the breed probably needs it. Middle son, Pete, is to be ordained as an Episcopal Minister in Alexandria, Va., next year. In January Tom will serve on a Reynolds Award Jury at Washington, D.C., after which the Fitzpatricks look forward to a sea-trip of an extended nature, hoping to return in April, at which time they make for their summer place in Western North Carolina.

Tom George comes through with an interesting bit; he is with the flight test department of Lockheed, on the L 1011, at the Lockheed Palmdale facility, but has time for some private flying and hiking. This past summer his son and he hiked across the Grand Canyon. . . . After a long time **Frank Gilmore** comes through with his present story. Frank has been at Cornell Graduate School of Business and Public Administration, but spent last year in Lausanne at I.M.P.E.D.E. Management Development Institute, which repeats a similar stint 14 years earlier. He adds that the climbing and skiing were great. . . . **William E. Rand**, is still manager of the Sea Ranch Association, in Northern California. Very brief, to be sure, but glad to get even this, Bill. We appreciate hearing from all these classmates and thank them as a group.

Address Changes: William E. Baur, ME; Frank Gilmore, MG; Cornelius J. Griffin, Jr., MG; Kenneth Moslander, MG; and John D. Sweeney, AR. Those wishing any of these last addresses, have only to write ye scribe, with the usual biographical material, and it shall be done.

We regret to announce the passing of one of our classmates, **Edwin H. MacEwen**, of Quincy, Mass. Mac was one of our architects, and designed several theaters, mostly in Quincy. He was the owner and publisher of Harrison Publishing Inc. and also established the

Bradford Price Book in Quincy. He is survived by his good wife, Dorothy, five sons, two daughters, two granddaughters, and one grandson. We wish to extend to Mrs. MacEwen, and the children, the most sincere sympathy of our class in their hour of sorrow.

This seems to clean up the material for this month. We really got quite a few names to mention, which is all good. I would rather have a bit of news from each of 100, than a lot from 10. It sells more papers. Again, we wish to thank all those kind folks who sent us Christmas cards and we do so appreciate hearing from y'all. Leona and I send our best from Florida.—**Warren J. Henderson**, Secretary, 1079 Hillsboro Beach, Pompano Beach, Fla. 33062

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Our class was honored indirectly when **Samuel Groves** was awarded the 1971 Bronze Beaver. The award came for many years of faithful service to M.I.T., capped in my mind, by his term as President of the Alumni Association. . . . An item from the Alumni office tells of changes at Mallinckrodt Chemical that has **Harold Thayer** moving from president to chief executive office. He retains his chairmanship of the board of directors. . . . From the same source I find that **Walter Bird** took part in a panel at the 1971 National Plastics Conference. Not very surprisingly, he spoke on "Plastics in Air Structures" and discussed the gradual acceptance in building codes of performance rather than specific materials. I can just imagine walking into our local building inspector with plans to put up one of Walt's structures!

I have a couple of items from people who were good enough to include some news with their Alumni Fund contributions. We are twice blessed—once for the gifts, and once for writing: **Timothy Coleman** says: "After retirement from Union Carbide subsidiary I have assisted in postal reform and reorganization as assistant postmaster general, southern region (11 states)." Some of this reorganization seems to be working. I've gotten some astonishingly fast deliveries on parcel post recently. . . . The other note is from **Richard Miller** who writes: "I retired from U.S. Steel in 1970, after 34 years in research and technology. This year I bought a house in Winter Park, Fla., and am now in the process of moving there from Pittsburgh, Pa., my home since 1942. My son Tom graduated from Williams in 1964 and his (brother, sister?) from the University of Denver in 1968. Both are married and have little girls. Best regards." Sorry about that blank, Dick, but you seem to have left one word out.

In the December issue I mentioned seeing **Winnie** and **Ted Taylor**. Comes their Christmas card and word that they are going to beat the New England winters again by revisiting Mexico. . . . Still on a personal note, I have recently been made chairman of the town Conservation Commission. It is slow work but we have finally succeeded in getting most of our salt marshes under either actual owner-

ship or easement control.

I realize that I missed the opportunity of the December issue to wish you all a Happy Holiday season. So let me at least hope the new year will be as good to us as we can make it.—**R. M. Franklin**, Secretary, Satucket Rd., Brewster, Mass. 02631; **G. G. Bull**, Assistant Secretary, 4961 Allan Rd., Washington, D.C. 20016

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Helen and **Sam Brown** sent me a happy and interesting Christmas letter and pictures of their children and grandchildren. "A Merry Christmas to all. Our son, Don, Dot and their daughters, Sharon age one-and-a-half, and Rita, age two-and-a-half, make their home in Somerset, N.J. Both little granddaughters are dynamic and friendly and rapidly changing as all tots this age. Don had a busy time at J. C. Penney's in New York working on computer data processing and other things—such that he was awarded an extra week's vacation. Our newest granddaughter, Elizabeth Ann (Beth) Winston, was born last March. Her mommy and daddy, Joan and John, make their home in Ann Arbor, Mich. They plan to be with us during the holidays, and right after New Year's will be taking a short ski trip to Vermont, leaving Beth with us. Joan is a full-time homemaker and also is taking courses at the university this semester. John has just about completed the courses for his doctorate, picking up his master's en route and will soon embark on his doctoral thesis in a branch of new and higher math. We are still playing golf individually and together. Sam remains a 22 handicap duffer, and Helen has her own high handicap too. Sam competed in the M.I.T. Class of 1935 Golf Tournament but lost in the finals. October found us in Barcelona, Spain, attending a meeting of the International Bridge, Tunnel and Turnpike Association at which Sam gave a technical paper. While there, we took the air shuttle to Valencia and had a reunion with our old friends, Doris and **Bob Carr**, who had just arrived to visit their newly married daughter, Jo Anne and her husband, German Sanchis. We all had a great day together, including a real Paella Valenciana. We then traveled on and spent a few days in Rome, Capri, Venice, Geneva, Chamonix (Mont Blanc), Normandy and Mont St. Michel and finally Paris. Thus 1971 for us and ours. To all of you, we wish good health and the Peace and Joy of Christmas throughout 1972."

Robert Spaulding sent the following note in thru the Alumni Fund office: I attended M.I.T. as a freshman only. I find the M.I.T. Alumni activities in this area far more interesting than those of another Cambridge university that I subsequently attended. . . . **Jack Holley** is his usual ebullient self, witness the following note also received thru the Alumni Fund office: "In for divorce again. Thanks be the farmyard's full of chickens. Had my third heart attack and ninth right shoulder dislocation (not concurrent). Do you suppose I've got a trick shoulder? Still employed—civil service—navy but what with austerity, how long?"

Rosemont College at Rosemont, Pa., announced the election of **Robert F. Flood** to the board of trustees. They went on to tell about Bob as follows: "**Robert F. Flood** attended Georgetown University for two years, then graduated from M.I.T. in 1935. Immediately thereafter, he joined the Linde Division of Union Carbide Corp. as development engineer and in 1962 became president of the division. In 1966 Mr. Flood was elected vice president of Union Carbide and presently serves in this capacity. The father of seven children, Mr. Flood's daughter, Patricia, is a junior at Rosemont. Also, he is a member of the board of lay trustees, Missionary Servants of the Holy Trinity and a Director of St. Augustine's Parish School Foundation of Larchmont, N.Y.

Changes of address have surfaced for **Jack Colby** who is back at Islamorada, Fla. for the winter; **Thomas K. Graham** is now located at 4040 96th Ave. S.E. Merce's Island, Washington; and **Ewing T. Spring**'s latest address is Box 5241, Grand Central Station, N.Y.C. On my last business trip to California I had dinner with Edith and **Ham Dow** and with Verna and **Gerry Rich**. It was my first and, I hope, last trip without golf clubs to the west coast. I am resting up a badly wrenched knee, in which I displaced the fibula, so that I can compete in our 12th class Golf Tournament coming in a few months.

Happy Vacation to all of you who are following the sun this winter—write when you get back. To the rest who are bogged down in day-to-day responsibilities in snow and slush country, keep well and do write—do it during the hours you used to spend watching N.F.L. Monday night football.—**Allan Q. Mowatt**, Secretary, 61 Beaumont Avenue, Newtonville, Mass. 02160

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Accepting a challenge to revitalize the White Motor Corp. of Cleveland has attracted two of our classmates: **Semon** (Bunkie) **Knudsen** has found another "auto" company and has become chairman and chief executive officer. **Spencer Mieras** has moved from Borg-Warner to become vice president—international. . . . They are not the only ones who have moved: **Jack Austin** is now on the east coast, his address is Sea Pines Co., Hilton Head Island, S.C. 29928. . . . **Gordon Thomas** is on the west coast with the Fluor Corp., Box 7030, East La Branch, Los Angeles 90022. . . . **Fred Assman** writes that he, Mary and the girls "had a grand vacation in Paris, Innsbruck vicinity and Connemara (which restroom door would you choose if they were marked 'MNA' and 'FIR'?)". On his return he found that his plant had been flooded with 10 feet of water (Thiokol Chemical Corp. in Trenton, N.J.).

Fred Carten reports on his move to Boca Raton and that he retired after 30 years with the U.S. Army as an officer and as a civilian. He expects to travel in this country and abroad for a time before settling down. . . . **Richard Lane**, a graduate member of the class, retired as director of engineering for the

Abrasives Division of the Bendix Corp., and has become director of marketing for the Frank Bancroft Company of Dearborn, Mich.

Investigation following discussion at our reunion has brought to light the heretofore unrecorded deaths of two class members: **Whitin Brewer**, and **Harry Tichnor**.

Your secretary continues to be grateful to those class members who send her clippings and notes about themselves or others. My thanks this month to Hank Lippitt, Leo Kramer and Elliott Robinson.—**Alice H. Kimball**, Secretary, 100 Memorial Dr., Apt. 8-6C, Cambridge, Mass. 02142 or P.O. Box 31, West Hartland, Conn. 06091

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Hjalmar D. Bruhn is a professor of agricultural engineering, University of Wisconsin, teaching courses in farm power and machinery. Over the years his research has resulted in development of tree planting equipment, mechanical cherry harvesting equipment, forage wafers and he is now working on mechanical dewatering of alfalfa and lake vegetation. . . . **O. William Muckenhirn** was elected 1970 "Engineer of the Year" by the Toledo Technical Societies and recently was elected National Director of Eta Kappa Nu Association. . . . **Harry N. Wallin** is now manager of projects, Mining and Metal Division, Bechtel Corp. He retired on October 31, 1968 as a rear admiral from the U.S. Navy, Civil Engineering Corps. . . . **George DeArment** was recently appointed chairman of the Meadville Area Recreation Authority which is the first such organization in the State of Pennsylvania. . . . **Ed Corea** received his 30-year service certificate and pin from the U.S.N. Supervisor of Shipbuilding, Quincy, Mass., in March, 1971. Last August Ed hosted the Charles River Wheelmen on their sunrise 35-mile bike ride through Hingham, Cohasset and Scituate.

Alfred C. Schroeder recently received the 1971 Vladimir K. Zworykin Award at the Northeast Electronics Research and Engineering Meeting in Boston. The Institute of Electrical and Electronic Engineers honored Al, a member of the Technical Staff of R.C.A. Laboratories in Princeton, N.J. for his "outstanding technical contributions to television and particularly his leadership in the development of color television." He started his television research in 1937, when he joined R.C.A. His work led to his invention of the shadow mask color tube utilized throughout the world. In all, he received 65 U.S. patents for his invention in television and allied fields.

It is with sadness, I report receiving a letter from **Les Klashman** in which he states that his wife, Betty, passed away on October 11, 1971, after a brief illness. Les had planned to retire from the U.S. Government Environmental Protection Administration in December 1971.

By the time you receive this issue of the *Technology Review*, you will have received a registration form for attending our 35th reunion at the Chatham Bars

Inn, on Cape Cod, June 2-5, 1972. If you haven't already sent in the form, now is the time to get it in the mail.—**Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, Mass. 02155; **Curtiss Powell**, Assistant Secretary, Rm-5-325 M.I.T., Cambridge, Mass. 02142; **Jerome Salny**, Assistant Secretary, Egbert Hill, Morristown, N.J.

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It appears to me that there could be considerably more alumni news to report from the Class of '38 for this issue—but we have been somewhat let-down as far as correspondents go. No doubt this is due to the resultant after-holiday (cash) blues!

At any rate, here goes: **Burt Grossel-finger's** postcard does a neat bit of theatre advertising; for those wishing to witness his talents, he is appearing at the Playbox Studio, 94 St. Mark's Place, New York City, in "Tidings, Comfort, and Joy." After viewing the multiple photos on the card, aside to Burt: How many faces of Burt can there be? . . . **Walt Johnson** tells us that he had been indulging in much variety situation-wise until April of this year when he joined the engineering department of Digital Plant, Boston. Let's hope he has found his niche. . . . We all know about the popular concept of recycling of waste and realize its vast importance. As Director, Division of Information Services at the Appleton, Wis., Institute of Paper Chemistry, **W. S. McClenahan**, directs major efforts toward the development and promotion of computerized information storage and retrieval services—really getting down to the nitty-gritty!. . . . Most unusual, to say the least, but to quote my good friend **Ed Hadley**, "I'm a grandmother at last"—(some people do make nervous grandparents—or, did "grandmother" actually write your card?) Ed relates more news about his son than himself. Young George is now employed at the University of Stuttgart, Germany—quite a ways from home.

I leave you for the nonce with the good word that though we may be experiencing a "bit of weather" right now, remember that "Spring is just around the corner"—the one after the next big snow-storm!—**A. L. Bruneau, Jr.**, Secretary, Hurdman and Cranstoun, Penney and Co, 140 Broadway, New York, N. Y. 10005

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The arrival of winter on Nantucket brought a bit of snow, sunshine and cold weather, and a promise of a fine year for your secretary and hopefully for all the members of the class.

Good news about two of our members: **Rogers B. Finch** of Rensselaer Polytechnic Institute has been elected to the position of Executive Director and Secretary of the American Society of Mechanical Engineers. The announcement was made November 29 and we send our warmest congratulations to Rogers. He has been at Rensselaer Polytechnic Institute for 17 years in various positions,

and early in the 1960's served as director of university relations for the Peace Corps. . . . Another press release from A.S.M.E. shows **Kenneth A. Roe** named president for the 1971-1972 year. Ken served in the navy during World War II and after receiving his degree from M.I.T. he joined the firm of Burns and Roe. As chief operation officer of that firm, Ken logs an average of 150,000 air miles a year visiting company projects around the world. He is a member of many organizations, and is chairman of the Industry Advisors' Committee to the Mechanical Engineering Department of Manhattan College. Ken has authored many technical publications and addressed numerous professional and industry organizations. Good luck to you Ken Roe in your new undertaking.

We have received the unhappy news that **Basil Staros** died on October 28, 1971. His family address is 12 Tuxedo Drive, Melville, N.Y. 11746, and we send along our heartfelt condolences to them.

William D. Hope died on May 29, 1971, and we had not heard of it until this week. A letter from Mrs. Hope to us was most inspiring with information about Bill's many activities and his compelling interest and faith in the young people of today. He had been a research engineering physicist with the Xerox Corporation for the past 15 years, and was about to complete seven years on the school board in Rochester, N.Y., at the time of his death. The family address is 40 Long-acre Rd., Rochester, N.Y. 14621.

A note from W. K. Hooper shows a move of himself and family to Pittsburgh, Pa. (Fox Chapel) after 23 years in Brookfield, Conn. National Steel's merger with Republic Steel, Inc. in 1969 moved the Hoopers where he is now vice president—administration with National Aluminum. They have three married daughters and two sons at home. . . . 1971 was a "degree year," for **William R. Stuart** and the entire family—Bill just received his Ed.D from the University of Buffalo, his son Joseph received his M.S. from University of Southampton in England, and daughter Marjorie received an A.A. from Southern Seminary and is now transferring to Cornell. A very good year for the Stuarts.

Sam Fry wrote from Seattle that he is still working at Boeing, presently on space shuttle systems engineering. He is very active in Seattle mountaineers and on local planning commission. Christmas time saw a double wedding for their two daughters. . . . Congratulations to **George E. Power** who was awarded a Ph.D. in materials science from the University of Cincinnati in August, 1971. George is performing a "first," as a research fellow at Formica Corp., Cincinnati. . . . Your secretary wishes you all the good things and among your resolutions he hopes you will find time to jot a line to him directly or through *Technology Review*, so all the Class can be aware of your activities.—**Michael Driscoll**, Secretary, Box 1044, Nantucket, Mass. 02554

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Sandford Peek writes that he is "having



It was "M.I.T. year" at the American Society of Mechanical Engineers' convention in Washington, D.C., in November, 1971. Kenneth Roe,'41, presided as A.S.M.E. President; Horace S. Beattie,'33 (with Mr. Roe, left and Mrs. Beattie, top picture) received the A.S.M.E. Medal; Luis Ferre,'24 (with Mr. Roe, center left) the Hoover Medal; Stephen H. Cran-

dall,'46 (at the left with Dudley D. Fuller and Charles E. Walker,'52, Undersecretary of the Treasury, center right) the Warner Medal; Charles S. Draper,'26 (with Allen R. Catheron, left, at the bottom left) the Oldenburger Medal; and William Webster,'23, (left, with G. E. Sherrod, at the bottom right) the John Fritz Medal.

a lot of fun developing and manufacturing new products based on ultraviolet radiation for the Hanovia Division of Conrad Precision Industries." . . . **Alan Macnee** is on sabbatical leave from the Department of Electrical and Computer Engineering at the University of Michigan. He is spending his sabbatical looking at circuit problems arising in measurement systems for high energy rays at Goddard Space Flight Center. . . . **R. S. Hill's** F.A.A. paper on S.T.O.L. is in the current Department of Commerce publications listing. . . . **Bob Howard** reports that he is attached to a group at Huntsville developing Hybrid Microcircuits for space computers. Bob had been doing work on the development of Laser trimming technology for film resistors. The November issue of *Solid State Technology* magazine carried an article by Bob on his laser work.

Just got a scouting report from **Paul Hotte** who attended an industry meeting at the Wychmere Harbor Club in November. He reports that the Harbor Club facilities and service are outstanding and enthusiastically recommends our Thirtieth Reunion to one and all. We have already received approximately forty reservations (this is being written in mid-December). If you have not sent yours in yet, please send it to **Warne Johnson, NOW!**—**Ken Rosett**, Class Secretary, 191 Albemarle Rd., White Plains, N.Y. 10605

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I hope you will overlook the fact that I did not present a column of class notes for the previous issue of the *Review*. The press of everything at home and in the business prevented me from completing everything we wished to do. We plan to make amends by producing a lengthy column for this issue.

We received a note from **Robert F. Nelson, Jr.**, describing his boy scout canoe trip in Maine during June. Bob, the scoutmaster, the assist scoutmaster and his family, another father and 21 boy scouts from Bethesda, Md. Troup 1092, began the trip on June 19 at Telos Landing in Maine. They traveled to Allagast Lake by way of Chamberlain Lake and Allagast Stream. The weather was good, and the winds fair, but only four fish were caught by the entire party. Bob found a wallet containing \$60 in the Allagast Stream, which is even better than catching four fish. . . . **Bob Bailey** reports he divides his time between the Whitehall Co. of Boston, where he directs the data processing and systems, and his numerous other activities. Bob is on the executive committee of the Metropolitan Area Planning Council, the Advisory Board of the Mass. Bay Transport Authority, and the Mass. Forest and Park Association. Bob is also active on the Mass. Federation of Planning Boards, the Board of Directors of the Greater Boston American Youth Hostels, and the Sharon Planning Board. Bob combines these worthwhile activities with bicycling, tennis and sailing with his six children.

John Gunnarson was kind enough to send me the biographical reports of three classmates that arrived too late for in-

clusion in the 25th reunion booklet. We are, therefore, pleased to share these with you. . . . **Raymond E. Benenson** is Professor of Physics at the State University of New York in Albany. Raymond graduated from M.I.T. in Course VI and received his Ph.D. at the University of Wisconsin. Raymond's wife, June, is a 1954 graduate of Wisconsin. He was married in 1956 to June Freedman and the Benensons now have three girls, aged 12, 10 and 6. Raymond belongs to the Sigma Xi and Sigma Pi Sigma, professional honor societies and to the American Physical Society and American Association of Physics Teachers, professional groups. Raymond's hobbies are tennis, which he greatly enjoys, and his hi-fi. My wife, Mary, and I, were pleased that we were at the Benensons' table at the 25th Reunion banquet and dance.

Pauline (Glazier) Teague, one of our few, but grand, female classmates has kindly enclosed the photo shown above. In September she and two classmates from Course XVI held their own 25th reunion at the San Juan Island home of **Beverly (Beane) Graham**. **Betty (Bunte) Stevens** is the third member of the group. Betty and Pauline are "retired" but Beverly is still working.

John A. Knauss is the Dean of the Graduate School of Oceanography at the University of Rhode Island at Kingston, R.I. John received his M.A. and Ph.D. in oceanography after graduation from M.I.T. He married Lynn Mattson, a '49 graduate of Radcliffe, in 1954 and the Knausses have two boys, aged 10 and 8. . . . **Sterling S. Bushnell** completed his biography from his home at The Larches, Middle Warberry Rd., Torquay, Devon, England. Sterling is the senior project engineer for Howmet-Misco Ltd., a wholly-owned subsidiary of the American company, Howmet Corp. Since graduation Sterling has worked for Armco Steel in Ohio, the Breneman-Hartshorn Co. of Cincinnati, and then the Howmet Corp. Misco Division at Muskegon, Mich. The last 11 years Sterling reports, have been spent with Misco, making precision castings for jet engines, gas turbines and he has enjoyed every minute of it. The Bushnells have been in England about a year and expect they will have another year there. Their oldest boy is in the Army. M.P.'s near Reno, a daughter is now engaged to an Englishman, and the youngest two are attending grammar school. Sterling's wife is kept busy in the large Victorian house in which they live, and Sterling is well occupied by the large garden.

John Aitken, 3rd, is a partner in the C.P.A. firm of Mathieson-Aitken of Philadelphia. After graduation from M.I.T. John received his M.B.A. at the Wharton School of the University of Pennsylvania. John, his wife Marjorie, and four sons, aged 20 to 14, and daughter Julia, 10, live at 8210 Ardmore Ave. in Philadelphia. John is active in the American Institute of C.P.A.'s, Penn Charter Alumni Society, Wyndmore Little League Manager, and the Union League of Philadelphia. His hobbies are golf, baseball coaching and do-it-yourself building projects. . . . **John W. Taylor** has co-authored an important article "Digital Techniques Ad-



Left to right: Pauline Teague, Beverly Graham, and Betty Stevens, all of the Class of '46, at a recent gathering.

vanced Tactical Radar." For several years all receivers used by Westinghouse surface and shipboard radars were designed under his direction with special emphasis on reducing their vulnerability to jamming. John has worked as an advisory engineer since 1962 and has developed digital techniques for tracking radars which improved range resolution and tracking capability. He holds 20 U.S. patents on these radar techniques. . . . **Reuben Samuels**, Vice President and Chief Engineer of Thomas Crimmins Contracting Co. of New York City, was the guest speaker at the American Association of Cost Engineers September meeting. The topic of his talk was "A Heavy Construction Contractor Asks, Is the Low Bid Cheapest?"

We are pleased to announce that M.I.T. awarded the Bronze Beaver to **Donald A. Hurter** in November 1971. Don received the award for his consistent activity in alumni affairs as class officer, club officer, Alumni Fund worker and chairman and member of several committees. Don was particularly praised for his considerable efforts over the past decade to initiate Lifetime Learning Programs for M.I.T. alumni. . . . Until the next issue, good health and good luck.—**Russell K. Dostal**, Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

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You have all received the reunion notice and hope you are making provisions in the year's plans so that you can attend. It sounds like fun for the whole family. Gina and I plan to be there with Bob and Lisa and hope to do a little sailing. We will undoubtedly also bring our golf clubs so Gina can try one of the courses on which I killed snakes so many years ago.

The clipping services advise that **Russ Palmiter** has been named chief research engineer by Ace Medical Instruments of Somerville. . . . **Barrett Brown** has been named president of the Oxzyn company in Trenton, N.J. Oxzyn, a division of Aerosol Techniques is a maker and packager of private label cosmetics.

A note from **Walt Kern** advises that he is chief mechanical engineer for Tera-dyne in charge of electronic packaging and systems engineering. He lives on the beach in Cohasset, Mass., and though he has just obtained his eighth patent in the electronic packaging field he allows as to how business is still not great—maybe he can lead us to beach-combing. . . . **Martin Haas** worked for five to six years after graduation as an industrial meteorologist for several firms in the greater Boston area. He then affiliated with the air force—first with the Cambridge Research Labs in Bedford and now, since 1960, with Logistics Command and Systems Command also in Bedford. With the former he did project and administrative as well as meteorological work. At present he is a program analyst performing control functions for such offices as Spacetrack, Cobra Talon, and Combat Grande. Marty, his wife, two sons, and daughter reside in Reading, Mass. . . . A very nice letter from my old pal **Jim Prigoff** follows: "As a grandfather of one week I thought I'd check in to see if any others have arrived at that state in life. Our daughter Gail and husband Roy are living in British Columbia where they intend to farm. They have been joined by Rubian—seven lbs of him.

"Our twins, Bruce, a junior at Beloit and Wayne, a sophomore at Tufts; and daughter Lynn a freshman at Cornell. Arline is a supervisor at Community Mental Health in White Plains after a three-year stint in central Harlem with a rehabilitation program. She's become a pro in the field of para-professional training and is currently also teaching at the New School. I'm still exec. v.p. of Rosenau Brothers in the children's apparel field and just recently opened a new misses operation to be called "Habitat." Although I'm still actively playing squash racquets I retired undefeated as national champ from squash tennis two years ago. Arline and I have continued our travels and camping activities. This summer we took a pup tent and two sleeping bags to the West Coast—rented cars and drove and flew from Vancouver to Tijuana stopping at all the great beaches with a wonderful side trip into the Olympic Range and the Cascades. We are now reading and studying about Hawaii as we plan to go camping there next summer.

"I was elected a member of the Explorers sometime ago so that I travel vicariously through exposure to the exploits of others in the many months that I'm confined to the environs of New York. We're looking forward to the Twenty-fifth and the opportunity of renewing many old friendships." Thanks Jim. We'll see you in June. Trust that it will be a good snowy year for the winter sports devotees and as you read this, if all goes according to plan, we will be skiing the slopes of Switzerland. Drop a line.—**Dick O'Donnell**, Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

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Norm Kreisman and Gordon Johnson

were hosts at a stag cocktail party at Norm's home in Washington. They invited all 123 members of the class of '48 who live in the Washington area including Virginia and Maryland. After cocktails several classmates stayed for dinner with Norm and Gloria. . . . **Jack Page** has received 229 responses to his letter. Two hundred classmates have expressed their plans to support the 25th Reunion Gift and/or attend the Reunion. The level of support is encouraging and provides a starting point in our drive for a megabuck gift to M.I.T.

Marshall Dick writes from Montgomery, Md. He and Kathleen Davis were married in 1969. They are expecting their first child in April, 1972. At this point Marshall and Kathleen have an excellent chance of winning a prize at our 25th reunion in 1973 for being the parents of the youngest child. Anyone wanting to challenge them will have to begin their entry prior to October '72. In his job . . . Marshall is helping the navy abate pollution. . . . **Dick Snow** is joining Manning Fabrics, St. Pauls, N.C. as assistant to the vice president. Dick has been technical manager of B. F. Goodrich Footwear Co. in Lumberton, N.C. since January 1, 1966. Dick's 23 years of experience with B. F. Goodrich began after graduation in 1948.

The Alumni Association recently announced the presentation of the 1971 Presidential Citations to five alumni committees and councils. The following members of the class of '48 were among those receiving the citations: **Philip Lally**, **George M. Keller, Jr.**, and **R. Maurice Tripp** for contributions to the San Francisco Educational Council; **Gordon O. F. Johnson** as a member of the Washington, D.C. Regional Conference Committee and **Adolf F. Monosson** for participation in the National Coordination Committee for the 1971 Entrepreneurship Workshops.

Sonny Monosson's speech to a seminar on Venture, or High Risk, Development Capital at the University of Toronto School of Business was reported in the *Toronto Daily Star*. Ken Brock sent me the news clipping which describes Sonny as a soft selling bow-tied entrepreneur who works out of an office on School Street in Boston with one rented telephone. Sonny's subject was "How to Run a Business—Without Money."

Ben Kessel and his wife Phyllis were among the 63 people killed in October when a British European Airways plane crashed and burned in Belgium. Ben had been in London on business, when he and Phyllis took the flight to Austria where one of their children, Irene, 19, was spending her junior year in college. Ben's activities in the Alumni Association included being president of the M.I.T. Club of Framingham in 1964-65. Ben and six others formed Computer Control Co., Inc. in 1953. By 1966, when the company had grown to over \$20 million per year the company was merged with Honeywell. Ben received his master's degree from Course VI, EE, in 1948. He had graduated from Texas Tech with a B.S. in 1946.

Dick Harris has been elected to the board of trustees of Worcester Junior College. . . . **Don Davenport** is vice president and general manager of the Sunny-

vale Division of S.O.S. Corporation. The Sunnyvale and Ploverita Divisions of S.O.S. furnish over 80 per cent of all ordnance devices on the Apollo Mission (exclusive, of course, of the rocket motors).—**S. Martin Billett**, Secretary, 16 Greenwood Ave., Barrington, R.I., 02806

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As I attempt to meet a pre-Christmas deadline for these class notes, thoughts of my hoped-for annual February visit to St. Croix keep intruding. Fortunately, there are only a few notes this month.

Stan Margolin received a letter on stationery of the "South Sea Textile Manufacturing Co., Ltd." in Hong Kong from Mrs. Madeleine Tang, giving a new residential address for Mr. **Jack C. Tang**. How did Jack ever find a vacant apartment in Hong Kong? This could be a major accomplishment. . . . From M.I.T. comes word that **Ira Dyer** has been appointed head of the Department of Ocean Engineering beginning October 1, 1971. I believe Ira is also now listed as a full professor at the Institute. Congratulations, Ira.

William S. Edgerly has been awarded the 1971 Bronze Beaver "in grateful recognition of distinguished service to the M.I.T. Alumni Association." The citation reads: "Through a multitude of alumni leadership roles, he has contributed to the growth of Boston alumni activities, the M.I.T. Club of Boston, the Long Range Planning Committee on Clubs and Regions, the formation and early direction of the Alumni Club Advisory Board; has served the Alumni Association on its board of directors, as vice president and as chairman of the Alumni Advisory Committee to the M.I.T. Commission on Education. He has also served on two Visiting Committees of the Corporation and now serves as a member of the Corporation. In all these activities, he has inspired confidence and accomplishment among his fellow volunteers and given new vitality and direction to strengthening the Institute." Congratulations, Bill on this very special award, one which is certainly well deserved. Three members of the Class of '49 shared in the 1971 Presidential Citations of the Alumni Association: **William C. Howlett**, with the Washington, D.C. Regional Conference Committee; and **Jerome Leva, Jr.** and **Ronald L. Greene**, with the San Francisco Educational Council.

Henry S. Rowen has resigned as president of Rand Corporation, the resignation to be fully effective in 18-months' time. The article makes it clear that Rand has been a center of turbulence for some time, what with changing national priorities and attempts by the organization to diversify away from military research into domestic social issues. Actually, there is mounting evidence that "think-tanks" and other consulting organizations are going through very rough times. Many of us are keeping our heads down as much as possible. Nevertheless, life goes on. I wish for each of my classmates that 1972 will be a better and more fulfilling year than any before.

—**Frank T. Hulswit**, Secretary, 77 Temple Road, Concord, Mass. 01742

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Edward Friedman, Associate Professor of Electrical Engineering at the University of Hartford, was elected chairman of the faculty senate in June of 1971. He was also elected to a one-year term on the Board of Regents on October 19, 1971. Edward joined the faculty in 1962 and advanced to his present rank in 1966.

. . . **John J. Earshen** is assistant for electronics program in the office of vice president, planning and development at Cornell Aeronautical Labs, and professional lecturer at the State University of New York at Buffalo. He has been appointed to head the technical program for the Acoustical Society of America meeting in April at Buffalo. John has also set out on a lifetime goal of catching one of every species of sport fish. . . . **Robert W. Roig** is with the General Research Corporation in Arlington, Va. His present activities are concerned with providing technical support to A.C.D.A. Bob is still flying C-130's for the Air Force Reserve.

Claus G. Manasse has been with Borden, Inc. since January of 1971, where he heads up the budgets and planning department. Since August the family (wife-Ellen; son-Michael, age 3½; daughter-Karen, age 1½) have been living in Columbus, Ohio—near the University area. . . . **Jean P. Altorffer** has been vice president of the aluminum group of Howmet Corp., Greenwich, Conn., since April of 1971. Jean was previously with Pechiney (France) in aluminum fabricating. Howmet is affiliated with Pechiney, France. . . . The Winter Haven Mall, the largest enclosed, air-conditioned, carpeted mall in Central Florida, opened on September 23, 1971, where Miss America attended the ribbon-cutting ceremony. This mall is owned and was developed by **Jack Pines**. Ultimately it will comprise over 50 stores.

Bob Snedeker moved to Andover in September after taking position as vice president, manufacturing of Merrimac Paper Co. in Lawrence, Mass. He saw **Ross Karlson** in Wilbraham where Ross, his wife and their young daughter bought an old house with extensive acreage a year ago. Since then he has been rebuilding it. . . .

John G. King, Professor of Physics at M.I.T., has been selected as one of the recipients of the Danforth Foundation's annual E. Harris Harbison Awards for Gifted Teaching. The awards were presented at Washington University in St. Louis, Mo. The award includes a \$10,000 grant to be used by the recipient to further his academic career and interests. Professor King is a leading proponent of educational innovation and reform. He has introduced several new methods of teaching in his own undergraduate classes, including the concepts of "concentrated study" and "corridor labs," and has authored and co-authored many articles on these and other new teaching techniques.—**John T. McKenna, Jr.**, 2 Francis Kelly Rd., Bedford, Mass. 01730

Taj F. Hanna writes that after 15 years in the Blue Ridge Mountains of North Carolina he has moved to Newark, Del., RD #3 Quartz Mill Rd. He is now engineering supervisor, Equipment Products Division, duPont Co. Taj mentions "an unexpected dividend," a son, Jonathan Cary, born May 23, 1971. . . . **Don Tarinelli**, Vice President of the Palmer Tarinelli Construction Company of Bridgeport, Conn., has been named a director of Mays and Hildebrandt of Gainesville, Ga., a newly formed company in the manufactured home building business. The company has begun work on a new 100,000-square-foot plant and expects to be in full production in March. Don is a past president of the Bridgeport Association of General Contractors. . . . **Fred Stengel** has sent in a clipping announcing his appointment as vice president of Gulf United Nuclear Fuels Corp., with responsibility for the company's manufacturing activities in New Haven, St. Louis and San Diego. Gulf United is a newly formed corporation jointly owned by Gulf Oil Corp. and United Nuclear Corp. Among its major customers will be Commonwealth Edison, American Electric Power, Connecticut Yankee, Detroit Edison, Yankee Atomic and Duke Power. Fred, his wife Barbara and four children reside in Madison, Conn.

Charles H. Beckmann was recently promoted to colonel, U.S.A.F., and elected to fellowship in the American College of Physicians and the American College of Preventive Medicine. . . . **Ron Yoshida** is now employed as contract technical manager in Spacecraft Controls at Cal Tech's Jet Propulsion Laboratory in Pasadena. For 18½ years Ron worked at the Marquardt Company. . . . **Peter vonHippel** writes that he and his wife Jo (Josephine Raskind, S.M.'52), enjoy the relatively uncrowded living in Oregon, plus the mountains and skiing. Peter is professor of chemistry and director of the Institute of Molecular Biology at the University of Oregon while Jo is in private practice of psychiatry. They live at 1900 Crest Dr. in Eugene, Oregon. . . . **Sam W. Goodwin**, head of the science department of East High School, Rochester, N.Y. says that he is now playing the cello (taking lessons) and looking for a viola player to make a string quartet. . . . **William P. Chandler** notes that his daughter, Lisa, is now a high school senior and interested in Wellesley. His son, Jim, is a high school freshman and is taking up tennis. At age 14 Jim is as tall as his father, ten pounds lighter and wears shoes one size larger. Bill is manager of operations control in the marketing department of B.P. Oil Corp. His wife, Isabel, teaches English to foreign visitors. . . . **Phillip P. Crimmins** has been elected a Fellow of the American Institute of Chemists. Phil is a registered professional engineer and has been with the Aerojet Solid Propulsion Co. in Sacramento, Calif. since 1958 and is father of three children.

Harold McAleer, Publicity Chairman of the Reunion Committee says to watch the mails for information on our exciting 20th Reunion to be held at the Harbor-

side Inn, Martha's Vineyard, on June 2, 3 and 4, 1972. Your committee is hard at work planning the details.—**Arthur S. Turner**, Secretary, 175 Lowell St., Carlisle, Mass. 01741

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Winter is upon us, and for those of you that live in warmer climes, I want you to know that snow exists. If it weren't for some minor matrimonial matters, I'd be munching mangoes on Maui.

Gary Brooks has been elected vice president of marketing for Scott Graphics, a subsidiary of Scott Paper Company. Gary is responsible for marketing all of the products of Scott Graphics, which has six plants in the Holyoke-South Hadley area engaged in the production of materials for the graphic arts industries. . . . **Joe Saliba** is now a consultant on the corporate marketing staff of I.B.M. He says that field jobs were more fun, though. . . . **Bill Deibel** has moved from Marion, Ohio, to the Detroit area to become manager of marketing of brakes and trailer axles for the brake division of the Eaton Corp. He found that **John Erickson** is the leader of the local Tech alumni group.

We learned that **William P. O'Neil** is now an engineer with the Industrial Products Division of the World Bank. He does a lot of overseas traveling in connection with his work. . . . A year ago **Dale A. Madden** joined the Food and Drug Administration as an operations research analyst after several years as a project engineer at Booz Allen Applied Research, Inc. . . . **Peter Toohy**, who is plant manager at Shell's synthetic rubber and plastics plant near Marietta, Ohio, has recently been elected to membership on the board of trustees of Marietta College.

Ronald W. Wolff has been appointed visiting associate professor in the Sloan School of Management for the 1971-72 academic year. . . . In October **Sandy and David Kramer** went to Japan for two weeks. He was a delegate to a conference on radiation effects in metals held in Kyoto. . . . **William Friedman, Jr.** writes that he has been busy not only building an addition to his house but also in a host of community activities. Among them is the chairmanship of the Des Moines International Indoor Tennis Championships, which he says will be on the Eastern Educational TV network on February 6.

In Alumni Association news, 1971 presidential citations were presented to the Washington, D.C. Alumni Fund Area Council, including **Milon E. Essoglou**; to the National Committee for the 1971 Entrepreneurship Workshops, which included **Austin R. Baer** and **Randall S. Robinson**; and to **Paul C. Valentine** of the San Francisco Educational Council. . . . A note from our former secretary, **Dell Venarde**, mentions that life is much freer now that both children are in school. However, she has postponed getting a degree in education on the grounds that there doesn't seem to be a shortage of teachers.—**Allan C. Schell**, Secretary, 19 Wedgemere Ave., Winchester, Mass. 01890

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Among the recipients of the 1971 Presidential Citations from the M.I.T. Alumni Association were **Jan Gerstenfeld**, **Don Roellke**, **Ed Roberts** and **Phil Richardson**. . . . **Henry Salzhauer** dropped the following line: "I feel kind of guilty for not giving Fred any past news but except for my wonderful family—my wife, son and two daughters—I have not done anything that I determine to be newsworthy. I am in the electrical contracting business in N.Y.C. with Benjamin Electric—where I have been since graduation. Regards to all. I hope to see you at the reunion."

Here is a letter from **Gerald Marwell**: "As you can see from the attached, I have something I want announced in the *Technology Review*. Namely, that yours truly is co-author of a book that every true intellectual will certainly want to purchase. Not that I make any money out of it; all the author's proceeds have been contributed to S.C.L.S. Nevertheless. You might also be interested in knowing that I have been promoted to full professor. On top of all that I have just finished writing a piece for the National Commission on Marijuana and Other Drug Abuse, titled "Adolescent Socialization and Marijuana Use." What the Commission is going to do with that piece I'm not sure, but I expect to see it published someplace eventually. I have a faint suspicion that **Marty Goldstein** would not approve of my submitting this for publication—he was never a publicity hound—but he is now a post-doctoral fellow in mathematics at the University of Montreal, and was married at the end of this past summer." . . . **John Best** is manager of the Education and Training Department of Electronic Associates Inc., manufacturers of scientific computers and graphics systems. He is married with three children. . . . **Peter Sinz** who is living in San Juan writes that he is now working as assistant to the president of Caribbean Fire Protection, a firm designing, fabricating and installing all kinds of fire protection systems. . . . A second note re San Juan: **Lester Gimpelson**, who is with I.T.T.'s world headquarters in New York, has written an article published in *Electrical Communication* titled "Computer Assisted Development of a Fundamental Plan for San Juan."

And now a third note re San Juan: Betty and I and our children (now three with the adoption of a 17-year-old Finnish boy) will be leaving Finland at the end of January. I've been named president of Mobil Oil Caribe, Inc., headquartered in San Juan. My responsibility covers Mobil's marketing operations in Puerto Rico, the other Caribbean islands and Central America. There is also a small refinery in Barbados, a gas company in San Juan, and perhaps something else—I just learned of the assignment last week and have not had a chance to look into the details. We're looking forward to the Caribbean, it will be quite a change from Helsinki. We hope we can have more visits from classmates. All who come are hereby invited to our house for a drink. We do not know what our address or telephone number will

be as yet but we can always be reached through Mobil. So please look us up and bring some news.—**Fred L. Morefield**, Secretary, c/o Mobil Oil Caribe, Inc., P.O. Box X, Caparra Heights Station, San Juan, Puerto Rico.

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Part Two of my report on the class questionnaire: The majority of the respondents (and presumably the class) said that they were in engineering, management or R and D. Only about 15 per cent were doing basic science. About 25 per cent are in teaching. While most people were satisfied or pleased with the way their career has gone only about 20 per cent said they were "extremely happy" with the way things have gone. Five people out of 270 said they were "very disappointed with the way their career has gone." Nearly everyone said that getting pleasure from their work was very important but 63 people said that they were not getting "the kind of pleasure they want" from their current job. It was important to nearly everyone to have some time off from their work for recreation but almost 100 respondents said they were not having enough time for recreation. Seven per cent of the respondents said they were unemployed—about the national average—but it seems to me that a sampling bias may have crept into this statistic since we might expect fewer of the unemployed members of the class to respond. About half the class is now working in a field different from their M.I.T. undergraduate major. Some people have had as many as ten jobs since graduation, while others have stayed at one place for the ten years.

Perhaps the most interesting responses came on questions dealing with career goals and motivations. More than half of the respondents don't care or expect to reach the top of their field. Only 21 people said that they wanted to be famous in their field. The most important career goal was challenging work not recognition or monetary reward. Doesn't sound like the "tech tool" to me! Strangely enough while most people are progressing through their career at about the rate they expected, 54 people said that they have gone "further" than they had expected. The overwhelming majority said that they wanted to be their own masters on the job while 32 said they wanted to be told exactly what to do. These same 32 said that "the type of work they are doing is not the kind they prefer."

About half the class has worked at one time in defense-related jobs, but only about 20 per cent are now in that category. Almost no one entered the military itself. Starting salaries were in the \$6 to \$10 thousand range while current salaries are in the \$14 to \$20 thousand area. The low current salaries belong to graduate students while the highest was about \$100 thousand (a management consultant). Eighty five per cent of the respondents were married and while 20 per cent of those had no children most families had one or two kids. One person reported

six! The majority did not want any more children. Nearly half the class never smoked and another 25 per cent have given up smoking. One person said he smokes pot regularly but in general we are a pretty square group with only about 25 per cent even experimenting with the stuff. Nonetheless, the overwhelming majority felt that penalties relating to pot should be either reduced or eliminated. Ten people did say that they felt the laws were not strong enough now. On the other hand nearly everyone felt that smoking marijuana was harmful although the majority said they thought it was no more harmful than drinking or smoking. Twenty people thought pot wasn't harmful at all.

Most respondents own their homes; values of the houses in the suburbs generally, range from \$20 to \$200 thousand (the management consultant, again). We seem to have a leftward-leaning class. The majority think of themselves as liberal or middle-of-the-road in both domestic and foreign affairs. Some changes seem to have taken place since graduation, for about a third of the class said they had become more liberal in the last ten years. In Vietnam affairs most people said that either South Vietnam or all of Southeast Asia would be communist if the U.S. had stayed out. In addition the majority felt that an immediate pull-out would doom the current South Vietnamese government. Nonetheless the majority said that the U.S. should pull out within a year or less. Interestingly enough the bare majority of the class supports Nixon's foreign policy while a substantial majority does *not* support his domestic policy. Nearly everyone thinks the President will be renominated in '72 and a sizable majority thinks Nixon will be re-elected. The majority said that they might not vote for Nixon—depending on the opposition.

Nearly everyone said they wanted more action on improving the environment (I guess that's like saying they are for apple pie and motherhood). And finally, a majority felt that the government should "establish incentives for smaller families." These are the preliminary results from the questionnaire. We will try to get more exact results and those will probably be mailed to the whole class. Thanks to everyone who answered. It's been interesting compiling this data. Next month I'll look at these results in light of the results of the old Sussman report data of our freshman year.

I have quite a pile of old cards from members of the class that I must get to now. **Joe Harrington** is "still with Commonwealth Edison (in Illinois) but I have been diverted, at least for the time-being from nuclear into electrical (power) engineering. I am currently the engineer for the northern third of the city of Chicago and am more concerned with the transformers, line and equipment to get the kilowatts to the customers than with the nuclear generating stations. We returned to Austria for a three-week vacation in June and July seeing old friends and reintroducing the two boys to their grandparents and visiting favorite spots from our years there." . . . Also out in the heartland is **Warren Lederman**

who wrote "I have been working in Milwaukee for the past three years for Johnson Service Co. specializing in fluids. This company is involved in heating and air-conditioning for large buildings. After many years of bachelorhood, I was married on December 24, 1970 to the former Ann Zussman of Milwaukee. I'm keeping cool up here." . . . **Fred Schmidt** lives out in the heartland too (I think that everywhere between Boston and 'Frisco is in the heartland) somewhere near Cleveland. He writes that the Schmidts had a boy, Eric William, last October. This makes two boys and a girl and he says "one more girl will set this family." By now, he will have presented a paper called "Red-Lite Development of Horizons Free Radical Photographic Film" in D.C. at a national meeting of the Society for Photographic Scientists and Engineers. I would congratulate Fred on the accomplishment if I could only understand the title!

Paul Hogle is also in Cleveland working at Cleveland Metal Abrasives as the manager of production and quality control but involved also in most other phases of the operation. Recently, he went on a trip around the world hawking abrasives. . . . Talk about the heartland, **Steve Salomon** came back from Siberia and went to Oklahoma. He is at the University of Oklahoma as a research fellow in the science and public policy program which is doing a technological assessment of offshore oil operations. On the side, he is also a visiting assistant professor of physics. . . . Back in Ohio (Columbus) **Al Brennecke** writes that he moved back to the U.S. from Brussels last September. He goes on to say: "My new position will be in the industrial nucleonics treasury department (finance) as assistant treasurer-international. Looks like very exciting times ahead. It is also good to be back after 3 3/4 years in Europe. Life in the big PX is taking some adjustment." Finally we close our quicky tour of the heartland in frozen Michigan where **Jonathan Buckley** is associate professor at the University of Michigan and is the chairman of the environmental service engineering program (very impressive, Jon!) He and wife, Trudy had a daughter nearly a year ago and they called her Nancy Oliver Buckley. He says Nancy was (get this) "the first daughter in my family in 135 years. We are very fortunate and pleased to have both Nathaniel who is three and Nancy." Next month I'll devote the notes to people living on the coasts (all very cultured people).—**Andrew Braun**, Secretary, 464 Heath St., Chestnut Hill, Mass. 02167

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The only letter this month is from **Chico Gholz**. Chico is now the treasurer of the M.I.T. Club of Baltimore. He reports that not many recent alumni are active in the club, but that the old-timers are pretty bright for all their being over thirty. Chico also reports the publication of a paper titled "Commissioners for the Court of Customs and Patent Appeals" in the *Journal of the Patent Office Soci-*

Doctorates

This month's stock of clippings includes news of a number of new Ph.D.'s in our class. **Steve Loutrel** received his doctorate from M.I.T. in June 1971 and is now teaching in the Design Group of the Mechanical Engineering Department at Tech. . . . **Tom Morrin** received his Ph.D. in electrical engineering from the University of Washington last June. Tom is now with the I.B.M. Advanced Systems Development Division in Los Gatos, Calif. Tom and his wife Barbara were expecting a second child last November. . . . **James Chang** received his Ph.D. in chemistry in March 1971 from Berkeley and has stayed on there as a post-doctoral fellow in the Space Sciences Laboratory . . . **Charles Albers** received his Ph.D. in August 1971 from the University of South Carolina. He is now with the Naval Ordnance Laboratory in Silver Spring, Md.

Moving on

Adrienne, Debbie and John Beckmann moved at the end of August (1971) to a new home in a town on Long Island Sound. John is the controller of the Dushkin Publishing Group—a new firm for college texts. John says his office is right on the water. The view must be pretty wild this time of year. . . . **Allen Pogeler** took a job with the Machinery Group Planning Staff of F.M.C. Corp. in Chicago after receiving his M.B.A. from Harvard last June. Allen's wife Jane is now working on her second novel. . . . **George Hadley** has started working for the University of Stuttgart Regional Computer Center. Thus he has moved his kayaking and skiing base of operations to southwestern Germany. George says he is slowly learning German but it is difficult since almost all the computer work is done in English.

Promotions and Publications

Alan Leslie received an award from the Harvard-Kennedy School of Government for his research on heroin addiction in New York City. The research addressed the costs and benefits of addiction reduction programs and was published in *Case Studies in Public Policies*. Alan is special assistant to the health services administrator of New York City. His research has been a significant factor in H.S.A.'s development of addiction programs. Alan holds an M.S. in industrial management from Carnegie Mellon and a Ph.D. in decision theory from Harvard. . . . **Don Minnick** was promoted last July to supervisor of cash management in the banking department of Ford Motor Company's treasurer's office. Don and his wife Carol report the birth of their first son, R. Donald Minnick, 3rd on January 7, 1971. . . . **Mike Hester** beat the wage freeze in October by being promoted to group engineer of the commercial flight test computer applications group (presumably in a southern California aerospace company—I don't know which). Mike also reports the addition of a six-month-old baby to the family. . . . **Dick Schmalensee** has a new book, *On the Economics of Advertising* coming out this

spring from North Holland. Dick is an assistant professor of economics at the University of California (San Diego) and has two more books accepted for publication.

Other Notes

I participated last month in the Alumni Fund Telethon and ran into **Steve Ivester**. Steve is now at Polaroid in Cambridge as a mechanical engineer in product development. . . . Other news from the telethon: **Arnold Abrams** is now chief resident in pathology at the University Hospital in Cleveland. . . . **Dick Gray** is a lawyer in New York City. . . . Finally, the picture of M.I.T. President Jerome Wiesner in the October 4, 1971 *Chemical and Engineering News* was taken by **Tom Maugh**.

The coffers from which the news is taken are growing thin this month. The usual pleas for letters is hereby issued—**Steve Lipner**, Secretary, 3703 Stearns Hill Rd., Waltham, Mass. 02154

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As one slowly begins to identify with the out-of-school crowd, the contacts with campus life seem to dwindle and it is always good to renew them. **Bo Pasternack** received his Ph.D. last June from Stanford and is now working at the Transportation Systems Center in Cambridge. . . . **Donald DeAngelis** has completed his Ph.D. in physics at Yale. . . . Northwestern University granted a Ph.D. in political science to **Michael Leavitt**. Michael was a member of the first S.B. class in Course XVII. . . . **Roland Pittman** completed his work for a Ph.D. in high energy physics this fall and has accepted a post-doctoral position in physiology at the University of Virginia. . . . **Roy Schwitters** also received a Ph.D. in high energy physics this past June. He now works at the Stanford Linear Accelerator Center and has a new son, Marc, born in September. **Dick Leonard** received his master of city planning from University of Pennsylvania last May and has been working with Rahenkamp Sachs Wells and Associates doing site planning and research on urban systems.

In addition to these lucky few, I have heard from a number of classmates who are still hard at work. . . . **Howard C. Hutt** is in Sweden working on his Ph.D. in math. . . . **Allen Post** is working at MITRE while working on an M.B.A. at Boston University as a part-time student. . . . **Michael Kraus** and his wife, Jane, are living in Montreal while Michael works on his Ph.D. in meteorology at McGill University. They had their first child, Pamela Cheryl, this past May. . . . **Wendell Snyder** is at the University of Minnesota working on a Ph.D. and **John Torode** is at the University of Washington working on a Ph.D. in computer science. . . . **Monty Graham** has spent this past year and this fall at a "fledgling graduate school of business administration" in Managua, Nicaragua. This next year he will return to Boston to finish his doctorate at Harvard Business School. . . . **Joe Sullivan** writes that he has enrolled at Carnegie-Mellon hoping to receive an

M.S. in May 1973. He is at the School of Industrial Administration.

Our class has also been busy in many other ways. . . . **Damian Kulash** and his wife Marjorie had their first child, Patricia Mary, on October 11. . . . **Charles K. Erdelyi** announces that his fourth, a boy was born on August 20. . . . **Lewis Gaines** has "purchased a house in Framingham for our daughter Sheryl born in February." . . . **Edward Steinberg** married the former Sandra Burnstein on November 15 last year. . . . **Bill Dietrich** married the former Clare Strech Chapman and they now live "on the swinging East Side." . . . **Bill Cain** and **Dave Nicoli** both sent announcements of marriages planned for this past November.

On top of this, there have been many classmates who have had time for work. **Allen Inversin** writes that he has just finished a two-year tour with the International Voluntary Services teaching math and physics a bit north of Vientiane, Laos. He is looking for the "proof" that all triangles are isosceles (based on an incorrect, though convincing construction). Send all proofs to me and I'll see that Allen receives them. . . . **David Liroff** was a full-time professor in the School of Radio-TV at Ohio University. He is now executive-producer and program director at WOUB-TV in Athens (Channel 20). . . . **Dennis Jedlinsky** left Seattle along with Bev, two kids, and their dog to move back to Massachusetts to accept a position as Industrial Liaison Officer at M.I.T. He now "sits high atop building 39." That sure sounds like a difficult place to work! . . . **Ralph Schmitt** left McDonnell-Douglas to join North American Rockwell's efforts to win the space shuttle, "a program that alternately lurches between that great white hope and great white elephant." He also has added a third (and last) child.

And now, for those of you who have been following the continuing saga of **John Freeman**, we have just received the latest installment (albeit six months old). To bring you up to date, John went to Harvard Business School after graduation from Tech and from there went to the Office of the Assistant Secretary of Defense in Washington, D.C. where he served as an operations research analyst. A recent press release from Washington reads: "John Knox Freeman has been named a management analyst by the Overseas Private Investment Corporation, a government corporation formed last January to stimulate the investment of U.S. capital and know-how in developing nations and areas." . . . Until next month . . . keep those cards and letters rolling in!—**Tom Jones**, Secretary, 33 Commercial Wharf, Apt. 35, Boston, Mass. 02110

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I talked with class president **Gary Garmon** by telephone last week; evidently, he has many volunteer workers in the M.I.T. area, and plans for our five-year reunion are coming along fine. Since a large number of classmates live in the Boston area, we are expecting a good turnout. You will be hearing more from us about the reunion. I am certain that most of

us have had unexpected and rewarding experiences in the last five years. I believe that this notion of uncertainty makes life more exciting and livable. I, for one, don't know where I'll be in a couple of years, and this suits me fine. **Larry Constantine** sent a long letter that describes his experimental life style of recent years. Since I found the letter very interesting, I am quoting a good portion of it: "... But increasingly I am becoming enmeshed in the family relations area and deeply committed in a very personal way to bringing about social change in the marriage, family, and sex relations areas. Both Joan and I are in a two-year training program in family therapy at the Boston Family Institute.

"Our life style is still one of trying to avoid artificial separation of work, play, family and friends. Except for the two days a week I spend teaching in N.Y.C., we split time as 'housespouse' and researchers right down the middle. . . . I wouldn't give up the routine, day-to-day interaction with the kids for anything; few fathers are so lucky. (Joy, 3: 'Daddy, are you the mommy today? You are a nice person to be the mommy!') The research on group marriage is, of course, still a major focus in our lives. The last field research trip brought us close to the fifty-thousand-mile mark. . . . Jointly, we have had three articles accepted by professional journals, two published already, and by next summer we'll have chapters in seven books. We have been getting 30-40 letters a week requesting information on new family forms. We now have a national referral list of counselors and therapists who can work with people in unconventional marriages. In an effort to shortcut the long journal delay, we have made the invisible college visible and now put out a newsletter/exchange medium for research projects on emerging family forms. And we have been speaking two or three times a month before professional and other interested groups on changing marriage and family patterns. . . . I wish I could convey some of our sense of vitality in being part of what we feel are some very meaningful changes in the whole social fabric. I have been surprised by the direction I am going. In my craziest dreams I would never have guessed that my very first scientific publication would be in the *Journal of Sex Research*." I should note that a book from Larry's passing computer scientist days, *Fundamentals of Program Design*, will be published soon.

The better half of the Susie and **Bob Ramers** team recently sent some news. Bob and Susie (formerly Susie Cable) were married in November of 1969. They lived in New York for three years and moved to San Francisco last year. Bob works in financial planning and analysis for I.T.E.L.; he has managed to complete his M.B.A. (New York University) in his spare time, and he is now working on a law degree from University of Santa Clara. Susie will soon retire to the more conventional mother role, as their first baby is due in March. . . . **Fred Orthlieb**, having spent two and a half years in Washington, D.C., in research in oil pollution control, has been released from the

U.S. Coast Guard. He is now a Ph.D. student in design engineering at Carnegie-Mellon. . . . In June **Louis Schwartzkopf** married Janet Holstein in Berkeley. They are living in Berkeley where Louis is working on a Ph.D. in physics. . . . **Jim Sutton** will hopefully receive a Ph.D. in business from Stanford this year. He worked last summer for the President's Commission on School Finance; **Cliff Lawrence** and **Bill Ioup** also were working there as permanent staff members.

After two years in the army that included seven months in Vietnam, **John Riitsko** is back at Princeton continuing his work for a Ph.D. in physics. . . . **Thomas Maier** has received his Ph.D. in inorganic chemistry from University of Illinois and is working in a research lab of Eastman Kodak in Rochester, N.Y. He is married and has a boy and a girl. . . . **Larry Galpin** spent two weeks in Switzerland on a skiing vacation. . . . In July, **Carl Kalinowski** married Annette Golubiewski of Bridgewater, N.J. After a brief honeymoon on nostalgic Cape Cod, they returned to Santa Monica where Carl is still working on a voice recognition project. . . . **Russel Perkins** announces the birth of Margaret Ansley, 9 pounds, 3 ounces. . . . **Mike Crane** received his Ph.D. in operations research from Stanford. He is now working for Control Analysis Corporation, a small consulting firm created by some Stanford faculty members. . . . **Larry Burgess** married Elizabeth Schoen (Wellesley, 1970) June 12, 1971.

Jeff Dodson is a member of the Class of 1975 of the Harvard School of Dental Medicine. . . . **George Beardsley** has received a Ph.D. in chemistry from Princeton. . . . **Jim Fletcher** has been awarded First-Year Honors at the Harvard Business School. He will graduate this June. After graduation from M.I.T. Jim worked for two years as a systems engineer in the Missiles and Space Division of General Electric and for one year as a member of the technical staff of General Research Corporation. . . . **Paul Scheffler** has moved back East after receiving a Ph.D. in physics at Caltech. He has accepted an offer from Bell Labs in Holmdel, N.J. . . . **Jim Kirtley** received his Ph.D. in August and is now an assistant professor in electrical engineering at M.I.T. . . . **George Sacerdote** finished a Ph.D. in mathematical logic from Illinois and is now at Oxford on a post-doctoral fellowship. . . . As a last note, **John Toivonen** sends a big hello to all hackers in general and to the Burton Third Bombers in particular.—**Jim Swanson**, 508 Thompson Ave., Mountain View, Calif. 94040

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For the last time, greetings from scenic Cambridge. The movers are scheduled to come in about two weeks. Unfortunately we are still not sure where we will be living. Hopefully that will be resolved shortly. We'll start off the column with a Class Hero citation to **Dan Harris** who recently wrote us a very long letter. As you will see, Dan also deserves the "You Can't Keep a Good Man Down" Medal.

Class Hero

After graduation Dan followed the sun west and became a grad student in chemistry at Caltech. In October 1970 he married the former Sally Mais, a recent graduate in psychology from Pomona College. He and another grad student developed a freshman chemistry course which was so popular that a third of the class took it. Things were going so well that he was planning to finish this summer. Dan also took up flying and earned a commercial license, instrument rating, and flight instructor certificate. In the last year he was very active as a flight instructor. Then misfortune arrived, as Dan writes, "Though I have been as conscientious and safety minded as possible, one of my students and I met disaster in November. A form of judgement error allowed us to crash a Cessna 150 into a hillside near Riverside." Both survived and are expected to recover completely. Dan has a badly broken back that will take about a year to heal. Hopefully he will be out of the hospital by the time this is printed. He plans to be "the first person to lecture a Caltech course in a body cast." Best wishes for a swift recovery, Dan.

Ken Theriault is still in the navy, but reports that he will be out in September and plans to return to the 'tute. "It will be good to get away from uniforms". . . . **John Niles** has completed a course in aviation maintenance management at Naval Air Station Memphis and is now assigned to Patrol Squadron 26 in Brunswick, Maine. . . . From Hawaii, **Steve Reimers** writes that he is still Project Officer for the Navy Experimental Diving Unit. He is serving as the equipment readiness manager for the Navy/Makai Range Dive—a ten-day saturation dive to 520 feet off Makapuu Point, Oahu, that was scheduled for December 1971. . . . **Paul Forbes** has returned from an eight-month deployment in the Western Pacific, and is now assistant operations officer for Naval Mobile Construction Battalion Ten. He spent five months in Hawaii and three months in Okinawa, and expects to go to Rota, Spain soon for eight months. . . . **John McFarren** is at Udorn Royal Thai A.F.B. as a navigator/systems operator in the RF-4C. . . . Finally, **John Duncanson** has completed a year in Vietnam, and is finishing his tour in Germany. . . . On a happier note we now have

But, alas, there are only two weddings to report. First, **Les Kramer** was married on December 26, 1970 to the former Judy Goodman. He "finally" finished his Ph.D. in Course VI, and is now working at Lincoln Lab. . . . **Joel Tepper** will be married to Laurie Cohen from Kansas City in March. Joel is now a fourth year medical student at Washington U. Medical School in St. Louis.

Stan Humphries has been working at Lawrence Radiation Laboratory as a physicist while completing a Ph.D. in nuclear engineering at Berkeley. In December, he and his wife Sandy left for Los Alamos where he is doing post-graduate work in laser diagnostics of plasmas for the Sherwood Group. . . . **Bill Ohm** is in the second year of Harvard B School working on an M.B.A.

Since he has been bypassed by the draft, he plans to go into consulting work or to work for a small business upon graduation. . . . **Jim Lewis** writes, "Soon to be come 'Dr.' Lewis, going to say goodbye to bacteria and go to Cambridge, England to find out what worms think about (and if they do)." . . . **Charles Thorn** escaped the draft by three numbers last year, breathed a sigh of relief, and finished his work for a Ph.D. in physics at Berkeley. His wife Martha, formerly M.I.T. '70, had already completed a B.S. in genetics in March 1970. So off they went to Geneva where he has a one-year N.S.F. postdoc at C.E.R.N. . . . **Robert Terry** is now studying physics at Johns Hopkins, "knocking out a lot of problem sets and growing a beard." . . . **Phil Weidner** is now in the third year of Harvard Law School. He spent last summer in an internship program at the Legal Adviser's Office at the State Department, Phil reports the birth of a daughter, Anna Cristina, who is now 10 months old. . . . Finally, **Jack Cleary** writes, "Have returned to the academic life. Just beginning the first year at Harvard Law. The experience so far has been quite different and stimulating. It's great to be back in Boston, but not so great to be living on a student budget after working for a year."

After finishing Harvard Law School, **Steve Swibel** moved back to Chicago and passed the Illinois Bar Exam. He is now working for the firm of Sonnenschein, Levinson, Carlin, Nath, and Rosenthal. . . . Pam and **Scott Marks** have bought a home in Carlisle, Mass., with four acres and report that they are "enjoying the country living." Scott has left Arthur D. Little and is now with Index Systems, Inc. in Kendall Square. . . . **Virginia Fano** is living in Cambridge while she teaches at Newton High School. . . . **George Farra** received an M.B.A. from Stanford and is now an investment and facilities planning analyst for Imperial Oil Ltd. in Toronto. . . . **Reynold Martin** works for Brown and Williamson Tobacco Corp. as a chemical engineer doing process engineering work. He lives with his wife Rita and their daughter Jennifer in Louisville, Ky. . . . From Pittsburgh, **Richard Fox** writes that he is continuing as a systems engineer for the Westinghouse Computer and Instrumentation Division. Last year his job took him to South Africa, France, and Belgium to assist in sales presentations and to start up new installations. His specialty is the application of computers to steel mills. . . . Another world traveler is **Bob Phair**. He and his wife Judy spent last May in Europe. First they stayed with friends in Brussels, then they "bounced through France and Italy in an ancient VW." They have now moved to the D.C. area where Bob is a biomedical engineer in the math research branch of the National Institute of Arthritis and Metabolic Diseases and Judy is the editor of *Where* magazine. . . . That's all folks, see you again next month—**Gail** and **Mike Marcus**, Secretaries, c/o *Technology Review*, E19-430, M.I.T., Cambridge, Mass. 02139

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Greetings from Cambridge! As I write this installment of our class notes, it is a beautiful, sunny day with temperatures near 60 degrees. It would seem that spring has arrived early this year since today is the middle of December. Oh well, in just a couple of days I will be back in Wisconsin where winter is really winter.

Among notes from classmates, I have received the following. **Jim Truitt** got married this summer to Charmaine Accursio, who graduated from the University of Florida in 1969 and teaches in Miami. Jim and his wife are living in Coral Gables, Fla., where Jim is in his third year at the University of Miami School of Medicine. . . . **Benjamin Whang** was in Korea for the months of November and December as a technical advisor to the Republic of Korea. He is assisting the Korean navy in the construction of terror-cement boats. . . . **Allen W. Wiegner** is completing his second year with the U.S. Public Health Service Commissioned Corps at the National Institute of Mental Health in Bethesda, Md. . . . After spending the summer with his wife's folks in Denver, **Theodore R. Lundquist** is attending the University of Maryland Graduate School, "hoping to pass the physics qualifying exam in February or September of 1972. Questions about the practical wisdom of being in physics haunt me." . . . **Christopher Brooks** is working as a product engineer at the Nash Engineering Company where, among other things, he is responsible for a compressor package which is part of the system that will keep nuclear power plants' radiation levels near zero. Chris has bought a house in Ridgefield, Conn., and is going to school at night in pursuit of his M.B.A. . . . After working this past summer for Hughes Research Laboratories in Malibu, Calif., as a consulting astronautical engineer, **Eugene F. Mallove** decided to broaden his background to encompass the biological sciences. Accordingly, he is now working toward his doctorate in environmental health sciences—air pollution control at the Harvard School of Public Health.

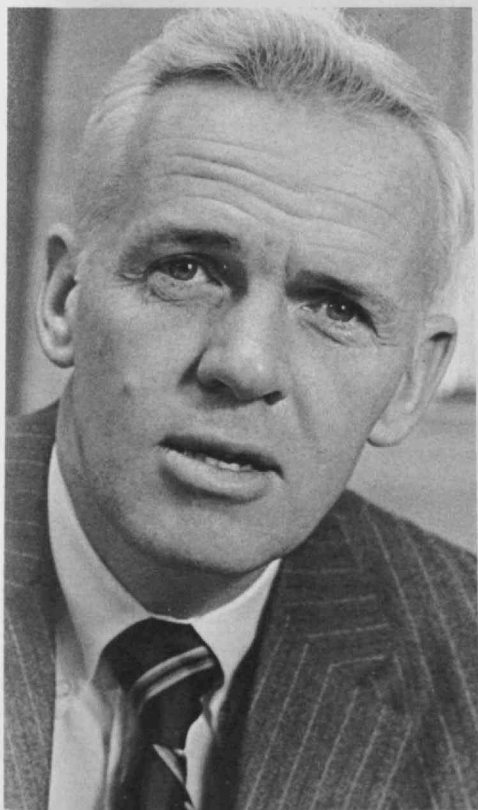
Michael J. Epstein received his M.S. in chemistry in September from Ohio State University. Mike is now broadening his background by working towards an M.S. in computer and information science. . . . **Bruce R. Donath** reports his family keeps growing. His wife, Peggy, delivered Jeffrey B. Donath on October 25, 1971. . . . Having married the former Cynthia Keenan after graduation, **Robert Harrington** spent nine months in the U.S. Army. Gladly returning to school, Robert is now in his second year at Stanford Business School working towards his M.B.A. . . . Princeton University announced the awarding of a master of arts degree in physics to **Marc Davis** on November 19, 1971. . . . **Dennis V. Swanson** was a recipient of the M.I.T. Alumni Association 1971 Presidential Citation for his work with the San Francisco educational council.—**Richard J. Moen**, Secretary-Treasurer, 412 Hastings Hall, Cambridge, Mass. 02138.

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Steve Oreck writes that he is an ensign, U.S.N.R., on active duty as an intelligence officer with an anti-submarine warfare squadron at N.A.S. Brunswick, Maine. He will be going overseas to Bermuda for four months this winter. . . . **Michael Robinson**, who was inducted at about the time he became an alumnus, should, if he gets "an early out," return to M.I.T. in February '72. He spent his army career in a chemistry lab stateside (Edgewood Arsenal, Md.). . . . **Carl Wickstrom**, writes that he's been "drafted, but not down and rejoicing to be near Boston and my girl." . . . **Daniel R. Cherry** has been commissioned as an ensign, U.S. Coast Guard Reserve, and has been stationed at the Captain of Port Office, Cleveland. He and Dianne Brown were married on January 24, 1971. . . . **Robert Hisiger** received a master's from M.I.T. in Course XVI in June, 1971, and is currently a project engineer at Clairrol, Inc., in Stamford, Conn. In August 1971 he married Ronda Wechsler of Bergenfield, N.J. . . . **Dave McComb** is self-employed as a general agent (an independent contractor) for American Data Registry. He writes that it is "rewarding work" and that he can offer positions to those interested in a career in sales. Dave is located in Boston and will be happy to hear from anyone. . . . **Elaine Leemon** and Daniel Gruber, '68, were married in July of 1970. Elaine states that the computer job market is quite tight for the inexperienced. . . . **Bob Dennis** is working in the Office of Management Planning in the Municipal Service Administration of New York City. . . . **Stephanie Schwartz** writes that she is working for a software firm doing work for Bell Labs, riding horses in her spare time, and has found a few moments to marry Robert Moore. . . . **William Copeley** has found work teaching math and science in a junior high school in Towville. **Paula J. Haughey** became Mrs. J. R. Fines '69, and her husband is presently pursuing a doctorate in physics at Princeton. . . . Graduate studies find **Paul C. Zimmermann** in astronomy at Berkeley and **Joel A. Mosher** in planetary science at Cal Tech. . . . **Jeffrey S. Sagarin** is taking graduate mathematics courses at Ohio State, while being a low-paid teaching assistant. . . . **John S. Carroll** has received a National Science Foundation Fellowship to study for a doctorate in social psychology. Helping him to study will be his wife, the former Helaine Dankner (Simmons '70). . . . Obviously enjoying the California sun more than the grey skies of Boston, **David Erickson** is now enrolled in chemistry at the University of California at Berkeley. . . . **Madeleine McClure** has decided to continue her education in electrical engineering at Stanford after having worked for Hughes Aircraft for a year.

Pax.—**Laura Malin**, Secretary, 406 Beacon St. #1, Boston, Mass. 02115; and **Robert Vegeler**, Class Executive Committee, 511 Beacon St. A-9, Boston, Mass. 02115

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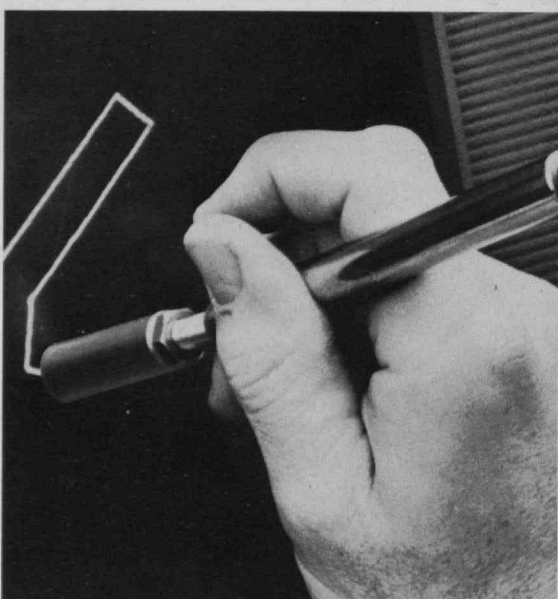
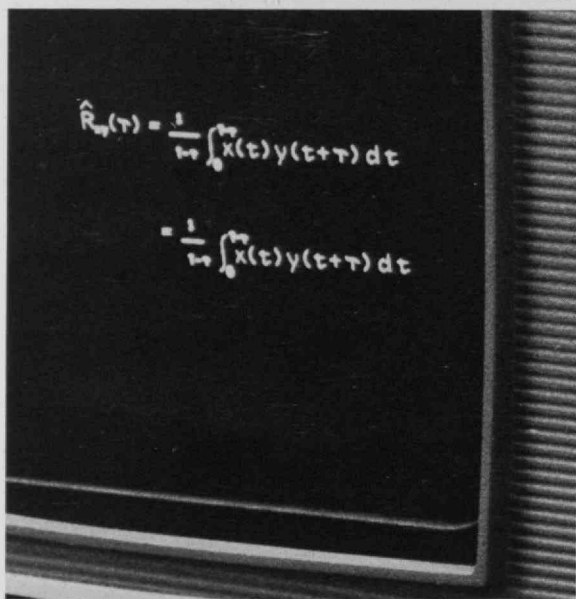
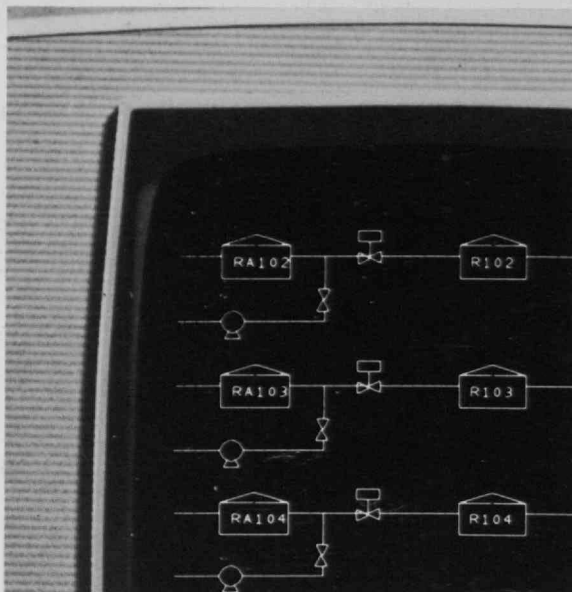
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